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NUTRITIONAL INTAKE OF FEMALE SOLDIERS DURING THE U.S. ARMY BASIC COMBAT TRAINING

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

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A study was conducted to determine how well military feeding addresses the nutritional requirements of female soldiers and if changes in the military menu over the past five years have lead to an improved nutrient intake pattern. The nutritional intake of 49 U.S. Army women was assessed for seven consecutive days during the 8-week BCT. The percentage of energy from fat in the menu was reduced from 38% to 33%, while the percentage of energy from carbohydrate was increased from 50% to 56%. Dietary cholesterol and sodium were less in 1993 than in 1988 (cholesterol: 928 mg versus 1299 mg; sodium: 1640 mg/1000 kcal versus 1731 mg/1000 kcal). Nutritional intakes showed a reduction in the percentage of energy from fat from 34% in 1988 to 32% in 1993. Dietary cholesterol intake, however, increased by 12%, in spite of its reduction in the menu. The difference was accounted for by the higher consumption of visible eggs in 1993. Sodium intake decreased from 1792 mg/1000 kcal in 1988 to 1541 mg/1000 kcal in 1993, mainly through a decrease in table salt usage. Mean intakes of < 100% MRDA were noted for vitamin B_6, folic acid, calcium, magnesium, iron, and zinc in 1993. It was concluded that the improvements in the nutritional intake were most likely due to menu modification, not to the individual choices.

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NUTRITIONAL INTAKE OF FEMALE SOLDIERS DURING THE U.S. ARMY BASIC COMBAT TRAINING

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Nutritional intake surveys require arduous work and prolonged hours of data collection. The authors greatly appreciate the efforts of the team members who helped with data collection (*SSG Josia S. Gamble, *MAJ Ronald L. Shippee, *Doris E. Sherman, [¶]Deborah A. Jezior, [¶]Susan M. McGraw, [§]Kevin D. Gilley) and data entry ([¶]David Corn). We are particularly grateful to those team members that were dual-hatted (SSG Gamble, who was also the project NCOIC, and MAJ Shippee, who also assisted with data entry and computer support).

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Special thanks goes to the 49 female soldiers who participated in this study. Their truthfulness, cooperation, and enthusiasm were unsurpassed. Without them, this study could not have been done.

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SUMMARY

A study was conducted to determine how well military feeding addresses the nutritional requirements of female soldiers and if changes in the military menu over the past five years have lead to an improved nutrient intake pattern for female soldiers. The nutritional intake of 49 U.S. Army women was assessed for seven consecutive days during one cycle of the 8-week U.S. Army Basic Combat Training. The soldiers received three meals per day served cafeteria-style at a dining facility or a field site. Dietary intake was assessed using a visual estimation method.

The percentage of energy from fat in the menu was reduced from 38% to 33%, while the percentage of energy from carbohydrate was increased from 50% to 56%. These changes align the menu with the current Military Recommended Dietary Allowances (MRDA). Dietary cholesterol was less in 1993 than in 1988 (928 mg versus 1299 mg). However, it remains considerably higher than the Military Nutrition Initiatives' goal of ≤ 300 mg by 1993. The reduction in sodium content of the menu from 1731 mg/1000 kcal in 1988 to 1640 mg/1000 kcal brought the menu within the target of an average of 1700 mg/1000 kcal of food served in military food service systems.

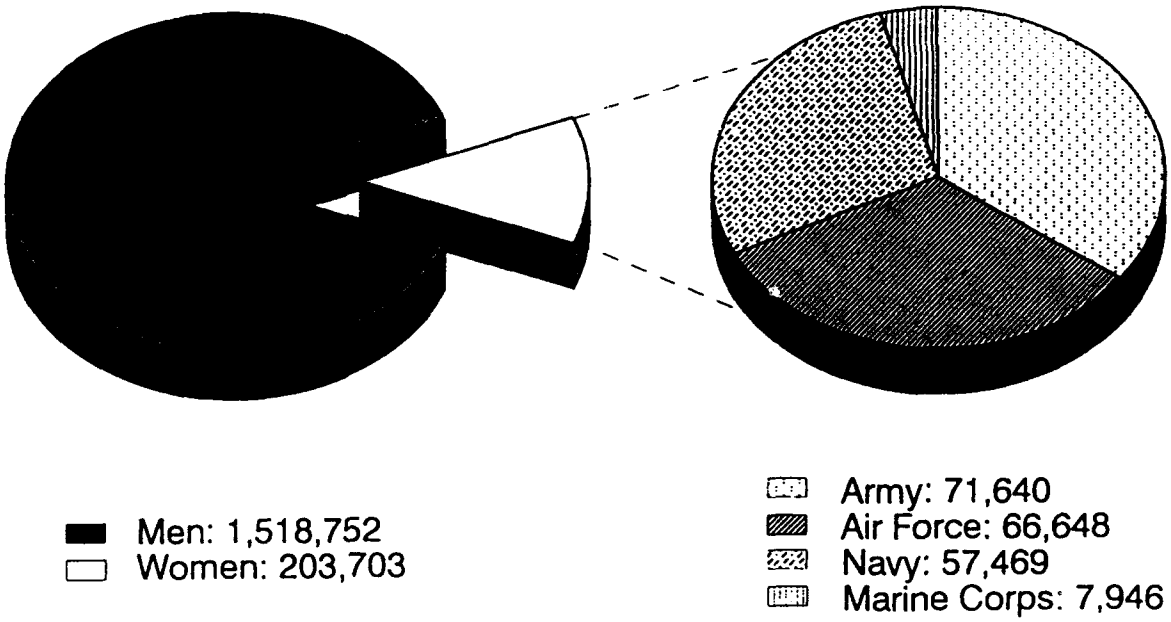
Nutritional intakes showed a reduction in the percentage of energy from fat from 34% in 1988 to 32% in 1993. Dietary cholesterol was up 12%, in spite of its reduction in the menu. The difference was accounted for by the higher consumption of visible eggs in 1993. Sodium intake decreased from 1792 mg/1000 kcal in 1988 to 1541 mg/1000 kcal in 1993, mainly through a decrease in table salt usage. Mean intakes of < 100% MRDA were noted for vitamin B_6, folic acid, calcium, magnesium, iron, and zinc in 1993.

It was concluded that the improvements seen in the nutritional intake of female soldiers in 1993 were most likely due to the passive intervention of modifying the menu, not to the individual choices. Nutrition education remains the cornerstone for motivating soldiers to adopt healthier eating habits that are consistent with current knowledge relative to healthy eating practices.

INTRODUCTION

For some time, the quota of women serving in any of the military services was set at 2%. In 1967, Public Law 90-130 lifted this ceiling, and between 1970 and 1980, the percentage of women in the U.S. Army escalated from 1.46% to 9.85%, almost a seven-fold increase (DMDC, 1988). As of 30 June 1993, women composed 12.3% of the U.S. Army active duty personnel (71,640 women) (DoD, 1993). Figure 1 depicts the female active duty military personnel as of 30 June 1993 (DoD, 1993). With over 203,000 female members on active duty in the U.S. military services (DoD, 1993), women have become an integral part of the Armed Forces. Yet, adequate information is lacking on the nutritional status of these women.

Figure 1. Female active duty military personnel



To date, no study has been conducted to determine how well military feeding addresses the nutritional requirements of military women. A small number of women (n=229) have occasionally participated in military nutritional surveys that included test subjects of both genders (Kretsch et al., 1986; USARIEM and USACDEC, 1986; Rose et al.,1989a; Edwards et al., 1991; Klicka et al., 1993) (Table 1). The results from these preliminary studies suggest that the nutritional problems of Army women are similar to those of the civilian female population, particularly when the majority of food consumption occurs outside the military dining facilities (i.e., in the field environment) (LSRO, 1989) (Table 2). The limited data available are inadequate to explain particular deficiencies. For example, the reasons for the low food consumption observed during the field studies could have been caused by a variety of factors, such as field conditions, environmental extremes (high terrestrial altitude, as in Bolivia), and the types of rations served. Furthermore, most of these studies did not include a complete battery of nutritional assessment tests (such as iron nutriture, body composition, and bone density), which could then be related to nutrient intake data.

Table 1. Description of previous military nutritional surveys with female soldiers

Type	Location	When	Duration	Ration[1]	Subjects Total / Females		Age[2]
Field	Hawaii	Aug 85	44 d	MRE/T	206	36[3]	23
Field	Bolivia	Jul 90	15 d	MRE/B[4]	80	13[5]	24
Dining Hall	West Point	1980	5 d	A	190	54[6]	20
Dining Hall	Ft. Jackson	Aug 88	7 d[7]	A[8]	81	40[9]	20
Dining Hall	West Point	Mar 90	7 d	A	205	86[6]	20

[1]The Meal, Ready-to-Eat (MRE) is an individually packed meal used in field situations when cooking equipment is not available; its components are heat processed in retort pouches. The B-Ration is used for group feeding in the field when cooking equipment, but no refrigeration, is available. B-Ration components are mostly canned and dehydrated foods. The T-Ration is also used for group feeding when neither cooking nor refrigeration is possible. This ration is ready-to-heat-and-serve with its components being thermally processed, shelf-stable foods, packaged in hermetically sealed, half-size steam table containers. The ration served in the dining hall studies was the A-Ration, which consists of perishable foods, served in dining facility settings or when cooking and refrigeration equipment are available in the field (NRDEC, 1992).

[2]Mean age of female subjects. [3]Combat Service Support.

[4]Plus a Carbohydrate Supplement (125 g). [5]Fifty percent Medical, 33 percent Engineer, 17 percent Other.

[6]Officer Candidates. [7]Non-consecutive.

[8]MREs served two days of field exercise. [9]Basic Trainees.

Table 2. Nutrient intake of female soldiers during military nutritional surveys

Nutrient	MRDA[1]	Field		Garrison			Nutrition Monitoring	
		Hawaii 1985 n=36	Bolivia 1990 n=13	West Point 1979-80 n=54	Ft Jackson 1988 n=40	West Point 1990 n=86	NHANES II[2] 1976-80	CSFII[3] 1985-86
Energy, kcal	2000-2800	1834	1668	2454[4]	2467	2314	1634	1675
Protein, g	80	67	68	84	96	79	64	65
Carbohydrate, g	330	235	218	284	318	325	195	198
Fat, g	< 93	70	57	107	94	81	67	68
Cholesterol, mg	< 300	-[5]	235	-	418	234	270	302
Vitamin A, mcg RE	800	1602	1030	-	1690	1250	-	-
Ascorbic Acid, mg	60	142	107	147	165	172	95	86
Thiamin, mg	1.2	4.0	2.0	11.6	2.0	2.8	1.09	1.17
Riboflavin, mg	1.4	1.6	1.5	9.3	2.2	3.0	1.49	1.51
Niacin, mg NE	16	17	19	37.3	27	30	16.2	17.3
Vitamin B_6, mg	2	-	1.5	-	-	2.6	-	1.2
Folic Acid, mcg	400	-	178	339	-	428	-	197
Vitamin B_{12}, mcg	3.0	-	2.1	4.7	3.7	6.2	-	4.5
Calcium, mg	800-1200	577	664	954	907	1001	662	691
Phosphorus, mg	800-1200	1065	1059	1347	1600	1391	1117	1065
Magnesium, mg	300	-	218	-	-	315	-	204
Iron, mg	18	11.9	11.7	16.2	18.4	28.0	10.7	11.1
Zinc, mg	15	-	5	11	-	14	-	8.8
Sodium, mg	< 4100	3343	3819	2764	4420	3703	2404	2593

[1]Military Recommended Dietary Allowances for moderately active military women, ages 17-50 years old (Department of the Army, 1985).
[2]Second National Health and Nutrition Examination Survey, women 20-29 years old (LSRO, 1989).
[3]Continuing Survey of Food Intakes by Individuals for 1985, women 20-29 years old (LSRO, 1989).
[4]Three percent of kilocalories provided by alcohol intake.
[5]Data not recorded denoted by "-."

Although many American soldiers have the option of consuming their meals away from the military environment, others (depending on their stage of military training) are required to eat in garrison dining facilities. Periodically, all soldiers eat military rations in the field environment during training or field operations. Military rations are produced according to nutritional standards, thus ensuring that the MRDA can be met (Department of the Army, 1985). The MRDA are established jointly by all military services, in concurrence with the Food and Nutrition Board of the National Research Council. The 1985 MRDA are based on the 1980 Recommended Dietary Allowances (RDA) (NRC, 1980) with the increased requirement of certain nutrients due to increased physical activity and, therefore, increased energy requirement of soldiers, compared to their more sedentary civilian counterparts. The MRDA are currently being revised to reflect the 1989 RDA.

The operational rations are designed to meet the energy and nutritional requirements of both male and female soldiers. In certain instances, because male soldiers require and consume more energy per day, the nutrient density of the ration (unit of nutrient per 1000 kcal) is not always optimal for the female soldier; therefore, depending on energy consumption of the female soldier, intake of some nutrients may be inadequate. For example, if a female soldier's energy requirement is 2400 kcal and she is eating MREs, she would have to consume approximately 131% of her energy requirement to meet the calcium MRDA of 1200 mg, or 166% of her energy requirements to meet the iron MRDA of 18 mg. Consequently, depending on the energy consumption of the female soldier, the intake of some nutrients may be inadequate.

The overall objective of the study was to determine if changes in the military menu over the past five years have led to an improved nutrient intake pattern for female soldiers. The purpose of this study was to assess the nutritional intake of U.S. Army women during the U.S. Army Basic Combat Training (BCT), to compare this intake with a similar group of female basic trainees that entered BCT five years earlier, to qualitatively assess changes in food intake during field training, and to compare the nutrition knowledge of those women who entered BCT in 1993 with that of those who entered BCT in 1988.

This report presents a comprehensive discussion of nutrient intakes. This study was part of a study on the health, performance, and nutritional status of the U.S. Army women during BCT (Westphal et al., in press). In addition to a general discussion on the nutrient intake, Westphal et al. discuss the anthropometry, body composition, blood chemistry, and strength-testing results. The Westphal et al. report also includes nutrition knowledge and beliefs, and food attitudes. The focus of this report is the comparison of the nutritional intakes of female soldiers attending BCT in 1993 with those who completed the training in 1988. In addition, the nutrition knowledge results of the 49 soldiers who participated in the nutritional intake part of the study are included in this report.

METHODS

STUDY VOLUNTEERS

Forty-nine female soldiers-in-training of the 1st Battalion of the 28th Infantry Brigade at Fort Jackson, S.C. volunteered and participated in the dietary assessment study while attending the U.S. Army BCT from 21 March through 20 May 1993 (8-week course). These soldiers were a representative sub-sample from a larger (n=158) study (Westphal et al., in press). All soldiers participating in this study received a volunteer consent briefing and signed a Volunteer Agreement Affidavit (Appendix A) prior to participating in this study.

MEAL SERVICE AND MENU

During this dietary assessment, the female soldiers were provided with A-Rations[1] prepared by using Version 4 of the Armed Forces Recipes Service (AFRS) (Department of the Army, 1989). The soldiers received three meals per day, most of which were consumed at the 1/28th Infantry Battalion dining facility. Four of the seven lunch meals were served in the field. Meal service was cafeteria-style at both

[1]The A-ration consists of perishable foods, and it is used in garrison dining facility settings or when food service personnel and equipment, including refrigeration, are available in the field (NRDEC, 1992).

locations. The length of the meal service was 1½ hours for the entire Battalion. Each Company within the Battalion was provided a scheduled 30 minute mealtime, which allowed a total of approximately 20 minutes for meal consumption. The menu provided for the seven days of the dietary assessment study is shown in Appendix B and followed the guidelines of the April 1993 Master Menu (Department of the Army, 1993).

DATA COLLECTORS

The dietary assessment data collection team consisted of 11 people, most of who possessed a diet/nutrition background or prior experience with nutritional survey data collection. The team was divided into five recipe specialists and six visual estimators. The recipe specialists worked in the kitchen area observing food preparation to record local deviations from the standard recipes. The visual estimators worked in the dining facility and at the field site during meal hours assessing each soldier's food consumption by visually comparing the amount of food on her tray to preweighed food standards.

Recipe Specialists

Prior to the start of the study, all five recipe specialists were trained by a registered dietitian on recipe data collection methodology. Three of the recipe specialists were registered dietitians, one was a nutritionist, and one was a chef. Two of the recipe specialists had previous experience as recipe specialists.

Visual Estimators

Prior to the start of the study, all six visual estimators were trained in this method by a registered dietitian who followed standard procedures (Rose et al., 1987). The training consisted of six sessions administered over a 3-day period and involved repetitive practice estimating portion sizes for different foods on plates, on trays, and in bowls. Food items for the training were selected based on consistency, shape, food combinations, and availability. Results of the visual estimation training revealed an overall mean score, expressed as a percentage of correct answers, of 80 ± 17%

(mean ± SD) for the six visual estimators; the mean score for the entrees was 82 ± 6%. All the visual estimators demonstrated an average proficiency of estimating portion sizes within ± 10% of the actual amount and were accurate to within a tenth of a standard portion.

The visual estimators were two registered dietitians, a nutritional biochemist, a sports nutritionist, a research psychologist, and a medical laboratory technician. Three of the visual estimators had previous training and experience using the modified visual estimation method (Rose et al., 1987).

DATA COLLECTION

Recipes and Menu

Prior dietary assessment studies conducted in military dining facilities have shown wide day-to-day variation in recipe preparation and, therefore, in nutrient content of recipes, even when using recipe cards (Rose et al., 1989a). Therefore, although the Contractor at the 1/28th Infantry Battalion dining facility used the AFRS (Department of the Army, 1989), the recipe specialists recorded the recipes used and documented any modification in type and amount of ingredients and preparation methods. While recipe specialists attempted to follow all prepared recipes, emphasis was placed on those with a large number of ingredients, since these recipes have a greater chance of varying from the standard. Recipes that included fat and water as ingredients were closely observed, since alterations in fat and water amounts can greatly affect the analyzed nutrient content.

At least two recipe specialists were simultaneously present during early morning (0400 to 1300 hours) and afternoon (1130 to 1700 hours) shifts. Their goals were to observe all food preparation by the cooks and to record, in as much detail as possible, all information regarding the preparation of each recipe. The recipe specialists met with the head cook to be informed of the menu items to be prepared and the cook responsible for each of these items. Due to the priority of recipes and layout of the kitchen, one recipe specialist followed entree, gravy, and soup preparation and the other followed vegetables, starch, and salads. The preparation of beverages (e.g.,

punch, ice tea, and juices) was often not observed, so an average recipe was compiled for each from any observed recipes, or the standard recipe from the AFRS was used.

Information collected on recipes included ingredient weights and volumes, ingredient label information, preparation method, and final product weight. Electronic scales of 30,000 g capacity (Sartorius, Brinkman Instruments, Westbury, N.Y.) and a temperature-compensated balance, accurate to 100 g (Metro Equipment Corp., Sunnyvale, Calif.) were used to weigh ingredients. In most cases, empty pan weights were recorded and then weighed as each ingredient was added. Ingredient weights were then calculated from the difference in weights before and after each ingredient was added to the pan. If ingredients could not be weighed, or if weighing an ingredient would have greatly disrupted the work flow of the cooks, volumes or counts of cans were recorded. This included counting cans of tomatoes added to spaghetti sauce, recording weights of bags of rice, or estimating quarts of water added to pancake mix. Ingredient labels were obtained during the preparation or recovered after preparation.

Final product weights were often difficult to measure. Since most of the weight change during cooking is due to evaporation, an estimation of water loss was determined using a calibrated 4-foot measuring rod marked in 1-inch gradations. It was placed in a steam-kettle once all ingredients were added and the marking was noted. After cooking, the rod was reinserted into the kettle and the new measurement was recorded. The amount of liquid represented by each inch gradation was determined. The difference between the measurements before and after cooking was used to calculate the approximate volume of water lost due to evaporation. This process was primarily used for recipes containing a large percentage of water, such as sauces and gravies.

Recipe specialists obtained a standard portion of each food served by kitchen personnel. The standard portions were weighed to the nearest gram or tenth of a gram using 500 and 5000 g capacity electronic scales (Sartorious, Brinkman Instruments, Westbury, N.Y.). Each food item was assigned a unique code, which was entered into a computerized coding file along with a serving unit and weight. This

file was then linked to food intake files. All weighed food standards for each meal were made available to the visual estimators so that they could observe portion sizes.

Dietary Intakes

The dietary intakes (food and fluid intakes) were determined for seven consecutive days using a modified visual estimation method, which has been previously validated (Rose et al., 1987; Schnakenberg et al., 1987). In the current study, this method involved each soldier showing her tray of selected food choices to one of the visual estimators before sitting down to eat. The visual estimator recorded the type and amount of foods and beverages on the tray using the preweighed food standards as models. Upon completion of meal consumption, the soldier showed her tray to that same visual estimator, who then recorded the type and amount of foods and beverages left on the tray, once again comparing with the preweighed food standards. In other words, the data collected consisted of food served and food not eaten (plate waste). A sample of the form used to record the food served and food not eaten is shown in Appendix C. Dietary intake data was later determined by subtracting the food not eaten from the food served.

If the soldier consumed less than half of any food portion, the visual estimator asked the reason for the poor consumption and then documented the reason in one of eight categories: (1) not hungry, (2) do not like, (3) sickness, (4) not enough time, (5) saving food for later, (6) dieting, (7) too full, or (8) food was cold. This information was also recorded on the Visual Estimation form (Appendix C).

Snack data (food and beverages consumed between meals) and meals consumed away from the training area (e.g., meals eaten at the medical facility) were recorded using diet recall in which the visual estimator asked the soldier at each mealtime to list any foods and beverages consumed since the previous meal. The visual estimator then asked specific questions (such as snack description, portion size, and amount eaten) to clarify the information provided by the soldier. This information was recorded on the bottom of the Visual Estimation form.

The visual estimators were present at the meal site 30 minutes before the Battalion was scheduled to eat. During this time, the visual estimators familiarized themselves with the menu items for that day and the portion sizes of the preweighed standards. Considering the 30-minute mealtime, each visual estimator was expected to collect data from approximately eight soldiers. Individual soldiers were not assigned to a particular visual estimator, thus the soldiers saved time by going to whoever was available. In the dining facility, the visual estimators were situated at a centrally located table, which facilitated collecting data from either of the two serving lines. Additionally, the table was located in front of the tray return as a reminder to the soldiers to show their tray to a visual estimator (the same visual estimator that recorded their food at the beginning of the meal) before disposing of the tray. In the field, most of the visual estimators stood at the end of the field table (a long, high table on which the soldiers placed their food trays and ate while standing around the table), while one visual estimator reminded the soldiers to go to the end of the table to have their food choices and plate waste recorded.

NUTRITIONAL ANALYSIS

The recipes, menus, and dietary intakes were analyzed for the following nutrients: energy, protein, fat (total, saturated, and cholesterol), carbohydrate, vitamin C, thiamin, riboflavin, niacin, vitamin B_6, folic acid, vitamin B_{12}, vitamin A, calcium, phosphorous, magnesium, iron, zinc, potassium, and sodium using the Computerized Analysis of Nutrients (CAN) System (Rose et al., 1989b) developed at USARIEM. The nutrient database in the CAN System is a composite of the U.S. Department of Agriculture Nutrient Data Base for Standard Reference Version 8 (USDA 8, 1989) and Nutrient Data Base for Individual Food Intake Surveys, which was adapted for the Continuing Survey of Food Intake by Individuals (CSFII) (USDA 2, 1986).

Recipes

Recipes were coded and analyzed for nutrient composition using the CAN System's recipe analysis program (Rose et al., 1989b). A combination of the ingredient yield and retention factor methods of re ipe analysis (Perloff, 1985) was used. These methods take into account cooking yields of individual recipe ingredients

and the retention or loss of vitamins and minerals of ingredients during cooking.

Nutrient database food codes were assigned to recipe ingredients based on descriptive and nutrition information on food labels obtained from the kitchen. If no label information was obtained, selection of database codes was based on information from the Federal Supply Catalog, C8900-Stock List, which lists specifications for food items available to military dining facilities. In some cases, ingredients were actually coded as a recipe, which could then be used as an ingredient if no appropriate match was found in the database. For example, the pancake mix was coded from the composition by weight of ingredients listed in the military specification. The pancake mix recipe was then coded as an ingredient in all pancake recipes.

When possible, database ingredients in the cooked form were used to represent the nutrient composition of the food as consumed. Raw recipe ingredient amounts were converted to cooked amounts by applying a yield percentage to adjust for moisture gains or losses during cooking (USDA 102, 1975). In some cases, the database food item contained a unit choice that allowed entering the raw weight of a cooked ingredient and the appropriate yield was automatically computed.

In cases when the cooked form of an ingredient was not available in the database, or further cooking or heating was performed on a recipe ingredient, USDA retention factors were applied. Retention factors adjust 18 vitamin and minerals to account for gains or losses due to specific cooking methods. The retention factor for reheating was often used in recipes to account for losses occurring when food items were kept in a hot holding bay prior to service.

The recipe analysis program in the CAN System has the capability to adjust entire recipes for moisture and fat gains or losses. For recipes in which evaporation was measured using the calibrated rod before and after cooking, the volume of water loss was converted to a weight and divided by the initial weight of the recipe to yield a percentage of water loss, which was then coded in the recipe. For some baked products, the cooked weight was divided by the initial weight of all ingredients, which was entered as a final yield percentage. Adjustments for water loss were automatically made for some recipes by the selection of the cooked database item for

all recipe ingredients. If moisture losses during cooking were not actually measured or accounted for by individual ingredient selections, water adjustments were estimated by using a standard final water percentage or water loss based on available CSFII recipe information. The water loss percentage function in the recipe analysis program calculates the weight of water lost, subtracts it from the initial recipe weight, and adjusts the final weight of the recipe.

While the recipe analysis program can adjust for fat (as it does for water), limited published data are available on fat gain and loss percentages. The recipe specialists attempted to measure fat gains and losses in the kitchen. For example, while the amount of fat used on the griddle for pancakes or French toast was measured in the kitchen, an assumption was made that the proportion of fat absorbed from the total amount used was the same as the proportion of space the item took up on the griddle. Likewise, weighing deep-fat fried items in the kitchen before and after frying does not reveal the amount of fat gained because the weight difference includes water loss as well as fat gain. Therefore, this fat was accounted for by coding a recipe as one ingredient that was fried, or by coding a recipe with the unfried item plus a quantity of fat based on assumptions about the percentage of fat absorbed (Appendix D). Assumptions used for fat absorption as well as other assumptions for recipe coding were obtained from the Trifoods Training Manual for Nutrient Data Base and Tufts University/New England Medical Center (DoD HS, 1989).

The standard serving sizes of recipes, which were obtained by recipe specialists prior to meal service, were included in each recipe. Recipes were analyzed by serving size and by 100 g servings. Nutrients per 100 g were stored in an output file for use in the analysis of dietary intakes. Associated files created during analysis included an ingredient and units file, which were used for the analysis of the 7-day menu.

Approximately 189 recipes were observed by recipe specialists and were subsequently analyzed. Twenty-one of these recipes contained at least one ingredient that was another recipe or a partial recipe. Approximately 16 recipes were not observed. These foods were assigned a recipe code from another day if available, or the standard recipe from AFRS was used. For single ingredient food items, such as

milk, margarine, and commercially baked products, an appropriate database item was selected based on descriptive or nutrient information obtained from the food label. Nutrient values for two items not found in an existing database were added to the study database.

Menu

The 7-day menu was analyzed using the CAN System's menu analysis program. Each food item available at each meal was coded with a unit, amount, and weighing factor. For recipes, a unit for a standard serving was used from the units file created in recipe analysis. Weighing factors were used, since the menu served at the 1/28th Infantry Battalion dining facility was a selective menu with multiple choices from a food group. That is, soldiers could choose one of two entrees. The weighing factor is the number of servings of an entree prepared, divided by the total number of entrees prepared. In the menu analysis, the factor for each entree was applied to a standard serving size of the entree so that each entree was not counted as one entire serving but rather as a fraction of a serving. The total entree contribution to the menu equaled one serving once these fractions of servings were added. For example, when the dining facility provided food for 1000 soldiers and prepared 600 servings of spaghetti and 400 servings of spareribs, weighing factors of 0.60 of a serving of spaghetti and 0.40 of spareribs were used. Menu factors were obtained from dining facility production figures. For items that did not list production figures, factors were obtained from the Army Master Menu information (Deparment of the Army, 1993). Discretionary items such as salt, tabasco sauce, and steak sauce (which were available *ad lib* on the soldiers' tables in the dining facility) were not included in the nutritional analysis of the menu.

Dietary Intake

The data collected by the recipe specialists (i.e., recipe data files) and the visual estimators (i.e., dietary intake data) were combined to calculate nutritional intakes. The macronutrient distribution (percentage of kilocalories provided by protein, fat, and carbohydrate) was also determined.

Menu items were categorized into major and minor food groups as depicted in Appendix E. The relative nutrient contribution of each of these major food groups (dairy, meats, combination dishes, grains, legumes, vegetables, fruits, desserts, fat and oils, and others) was determined for selected nutrients (energy, protein, fat, carbohydrate, sodium, cholesterol, vitamin B_6, folic acid, calcium, and iron).

FIELD FEEDING ISSUES

Previous nutritional studies have indicated a lower food consumption in the field (USARIEM and USACDEC, 1986; Edwards et al., 1991) than in garrison dining facilities (Kretsch et al., 1986; Rose et al., 1989a; Klicka et al., 1993). Field feeding issues were assessed using a questionnaire designed to capture information pertinent to the soldier's field experience during a 3-day Field Training Exercise (FTX) that was part of BCT. This questionnaire (Appendix F) was self-administered (n=153) after the completion of the FTX. The questionnaire ascertained if the soldiers perceived that they ate less during the FTX and, if so, identified possible reasons for the decreased food consumption.

NUTRITION KNOWLEDGE

Nutrition knowledge was assessed using the nutrition knowledge section of the Nutrition Knowledge, Attitudes, and Awareness Questionnaire used in the Fort Jackson dietary assessment in 1988 (Rose et al., 1989a). This questionnaire was selected to allow the comparison between the nutrition knowledge of women entering BCT in 1993 with that of women who entered BCT five years earlier.

The nutrition knowledge questionnaire was self-administered before BCT. The questionnaire consisted of 21 nutrition knowledge questions divided into 14 multiple choice and 7 true or false questions. To assess nutrition beliefs and food choices, the soldiers were asked to choose from a list of paired foods "the food choice that would help them practice better nutrition," and, then, to choose from a similar list of foods "which foods they would actually select if given the choices."

STATISTICAL ANALYSIS

Unless otherwise specified, data are expressed as mean ± SD. Data were analyzed using SPSS-X Release 4.1 for VAX/VMS (SPSS-X, 1988). Adequacy of nutrient intakes was determined by comparing the study means with the MRDA (Department of the Army, 1985). Differences among daily mean energy intakes (daily totals and by meals) were determined using an ANOVA procedure. A p value of less than 0.05 was considered statistically significant. The mean nutritional intake of U.S. Army women during BCT was analyzed using descriptive statistics, since there was only one study group. A comparison of these data with that of women entering BCT five years ago was made using descriptive statistics, because the differences in the food supply and in food composition databases between 1993 and 1988 preclude a direct comparison. Thus, a comparison of the percentages of soldiers with mean daily intakes at selected levels of the MRDA between the 1993 and 1988 studies was also done. Data on field feeding issues were analyzed using descriptive statistics. Nutrition knowledge data were analyzed using descriptive statistics and a t-test procedure.

RESULTS

STUDY VOLUNTEERS

Forty-nine female soldiers-in-training, from the 1st, 3rd, and 4th Platoons of D Company of the 1/28th Infantry Brigade at Fort Jackson, S.C., participated in the dietary assessment study during their second week of BCT. Tables 3 and 4 compare the volunteers of the current study (1993) with the women in the 1988 study performed at Fort Jackson, S.C. (Rose et al., 1989a). Table 5 includes additional information on the 1993 soldiers.

Table 3. Description of 1993 and 1988 study volunteers

Study date	1993	1988[1]
Sample size	49	40
Ethnicity (%)		
White[2]	65.3	63
Black[2]	22.4	18
Hispanic	12.2	18
Other	0	1
Age groups (%)		
≤ 19 years	38.8	75
20-25 years	44.9	20
26-30 years	14.3	5
31-35 years	2.0	0
Height, mean (cm)	165.4	162.6
Initial weight, mean (kg)	63.4	59.1
Trying to lose weight (%)	69.4	72
Trying to gain weight (%)	6.1	2

[1]Percentages for 1988 were rounded to nearest whole number and, therefore, may not add up to 100%.
[2]Does not include Hispanics.

Table 4. Description of 1993 and 1988 study volunteers (continuation)

Study date	1993	1988[1]
Sample size	49	40
Highest education level (%)		
Some High School	0	2
High School Grad or GED	59.2	73
Skilled Job Training	-	2
Some College	38.8	20
College Grad	-	2
Some Post-Graduate	2.0	0
Part of the country lived in the longest[2] (%)		
New England	4.1	3
Middle Atlantic	12.2	18
East North Central	22.4	22
West North Central	4.1	10
South Atlantic	28.6	5
East South Central	2.0	5
West South Central	6.1	18
Mountain	2.0	5
Pacific	14.3	13
Other	4.1	0
Marital status[3] (%)		
Single	81.6	85
Married	8.2	13[4]
Widowed/Divorced	8.2	2

[1]Percentages were rounded to nearest whole number and, therefore, may not add up to 100%.
[2]Three percent from 1988 did not respond.
[3]Two percent from 1993 did not respond.
[4]Includes 8% married and 5% separated.

Table 5. Additional description of 1993 study volunteers

Age, mean / range (years)	21 / 18 - 31
Height, mean / range (cm)	165.4 / 154.9 - 188.0
Initial weight, mean / range (kg)	63.2 / 48.1 - 87.5
Initial body fat,[1] mean ± SD (%)	31.9 ± 5.9
Initial fat-free mass,[1] mean ± SD (kg)	42.9 ± 4.8
Type of community lived in the longest (%)	
Central City	20.4
Suburbs	28.6
Rural	51.0

[1]Determined by dual-energy x-ray absorptiometry (DEXA) using a LUNAR DPX-Plus scanner and the version 3.6 software (LUNAR Corporation, Madison, Wis.).

MENU NUTRITIONAL ANALYSIS

The macronutrient distribution, and sodium and cholesterol contents of the 1993 and 1988 menus are presented in Table 6. The 1993 menu provided during the 7-day dietary assessment is shown in Appendix B, and Table 7 shows the average nutrient content, nutrient density, and percentage of the MRDA supplied by the 7-day menu.

Table 6. Menus mean macronutrient distribution, and sodium and cholesterol contents

Energy Distribution	7-Day Menu	
	1993	1988
% Protein	12.8	14.3
% Fat	33.4	37.9
% Carbohydrate	56.1	50.1
Sodium, mg/1000 kcal	1640	1731
Cholesterol, mg	928	1299

Table 7. Menu nutrient content, nutrient density, and percentage of MRDA

Nutrient	Amount (Mean)	Nutrient Density (per 1000 kcal)		% of MRDA[1]
		Study Menu	Recommended[2]	
Energy, kcal	5344	-	-	223
Protein, g	170.8	32	33	214
Fat, g	198	37	--[3]	--
Saturated Fat, g	58	11	--	--
Carbohydrate, g	749	140	--	--
Vitamin C, mg	244	46	25	407
Thiamin, mg	2.7	0.5	0.5	223
Riboflavin, mg	3.2	0.6	0.6	228
Niacin, mg	37.9	7.1	6.7	237
Vitamin B_6, mg	2.3	0.4[4]	0.8	116
Folic Acid, mcg	564	106	167	141
Vitamin B_{12}, mcg	11.2	2.1	1.3	372
Vitamin A, IU	20379	3814	1665	509
Calcium, mg	1759	329	417[5]	220
Phosphorous, mg	2785	521	417	348
Magnesium, mg	616	115	125	205
Iron, mg	32.9	6.2	7.5[6]	183
Zinc, mg	22.7	4.2	6.3	151
Potassium, mg	6498	1516	--	--
Sodium, mg	8765[7]	1640	--	--
Cholesterol, mg	928	174	--	--

[1]Military Recommended Dietary Allowances for females soldiers, ages 17-50 years (Department of the Army, 1985).
[2]Nutrient Density Index (Department of the Army, 1985).
[3]No MRDA established denoted by "--." [4]Low nutrient densities are denoted by shadowed numbers.
[5]Calcium and phosphorus densities were computed using 1000 mg (MRDA is 800 to 1200 mg).
[6]Iron density was computed using female soldiers' iron requirement of 18 mg.
[7]Discretionary items such as table salt not included on the menu analysis.

Since the dining facility offered one menu for both male and female soldiers, the average energy content of the menu available for the female soldier was high. Due to the high energy provision of the menu, all menu mean nutrients met the MRDA. However, the nutrient density of the menu did not provide optimal amounts of vitamin B_6, folic acid, calcium, iron, magnesium, and zinc according to the nutrient density standards in AR 40-25 (Department of the Army, 1985).

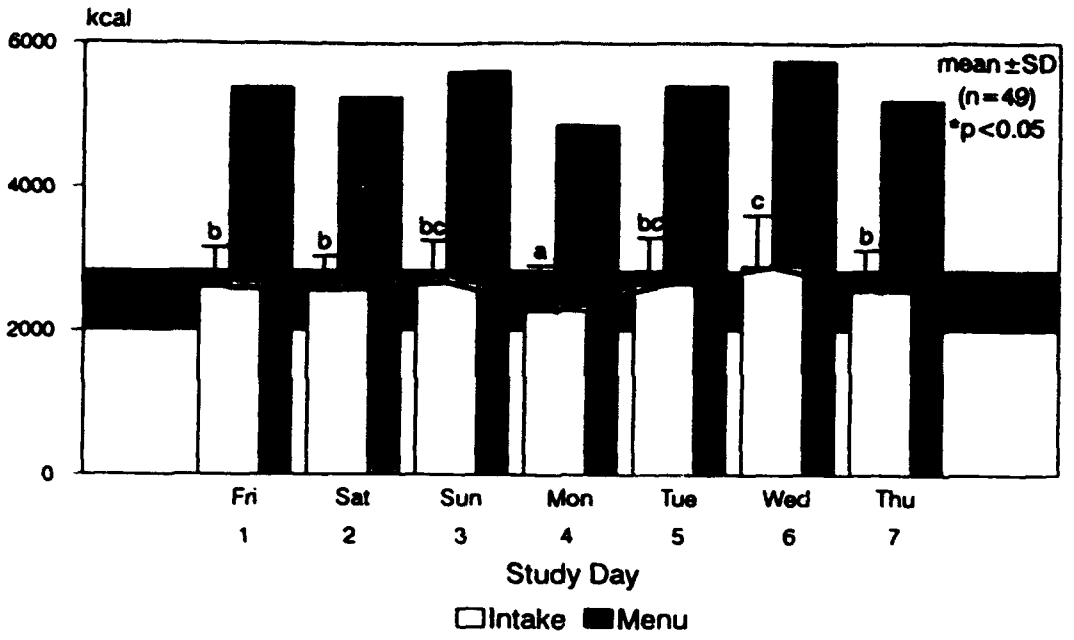
NUTRITIONAL INTAKES

Daily Energy Intakes

Figure 2 depicts the mean daily energy intakes as they compare to the energy provided by the daily menu for the 7-day study and the energy MRDA. Mean daily food consumption was sufficient to meet the energy MRDA each day. The mean daily energy intakes were different among some study days, as indicated by different letters. These differences were not due to the day of the week (weekend intakes were similar to that of some weekdays), or to the days in which lunch food choices were more limited when this meal was served in the field (days 2, 4, 5, and 7; see menu in Appendix B).

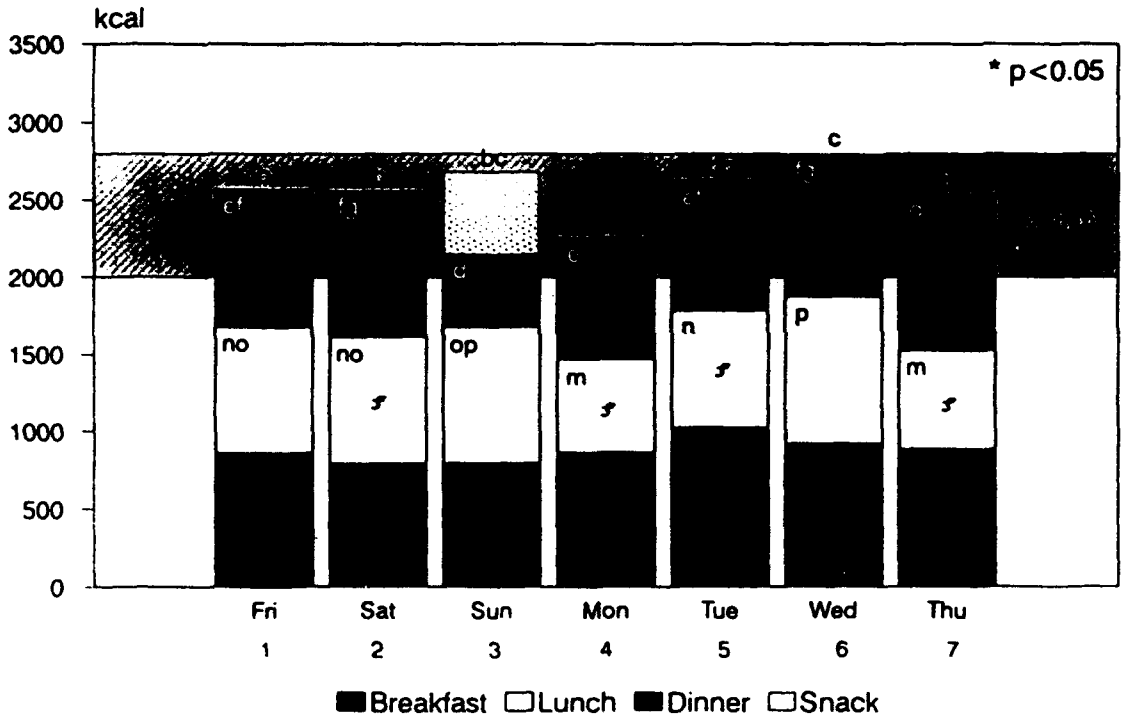
Figure 3 shows the contributions of breakfast, lunch, dinner, and snacks to mean daily energy intake. Comparable to the differences seen in the total mean daily energy intakes, the mean daily energy intakes for each meal was different among some of the seven study days. Once again, a pattern could not be detected to explain these differences. For instance, the energy intake at lunch on days 4 and 7 (field lunches) was smaller than the other lunches. However, days 2 and 5 lunches were also served in the field and the intake was similar to some of the dining hall lunches. The low intake on day 3 dinner was probably due to the snack food consumption, which occurred that afternoon when the soldiers went to the Post Theater. The mean daily energy contribution of snack foods for the soldiers who snacked on the indicated days, as reported by the 49 soldiers, was day 1, 375 ± 212 kcal (n=3); day 2, 0 kcal (n=0); day 3, 537 ± 391 kcal (n=47); day 4, 125 ± 72 kcal (n=4); day 5, 284 kcal (n=1); day 6, 252 ± 297 kcal (n=19); and day 7, 0 kcal (n=0).

Figure 2. Mean daily energy intakes



* Days with different letters are significantly different from each other.

Figure 3. Meals and snack contribution toward mean daily energy intakes



ƒ = lunch served at the field site.

* Letters within meals and for total intake denote statistical differences between days.

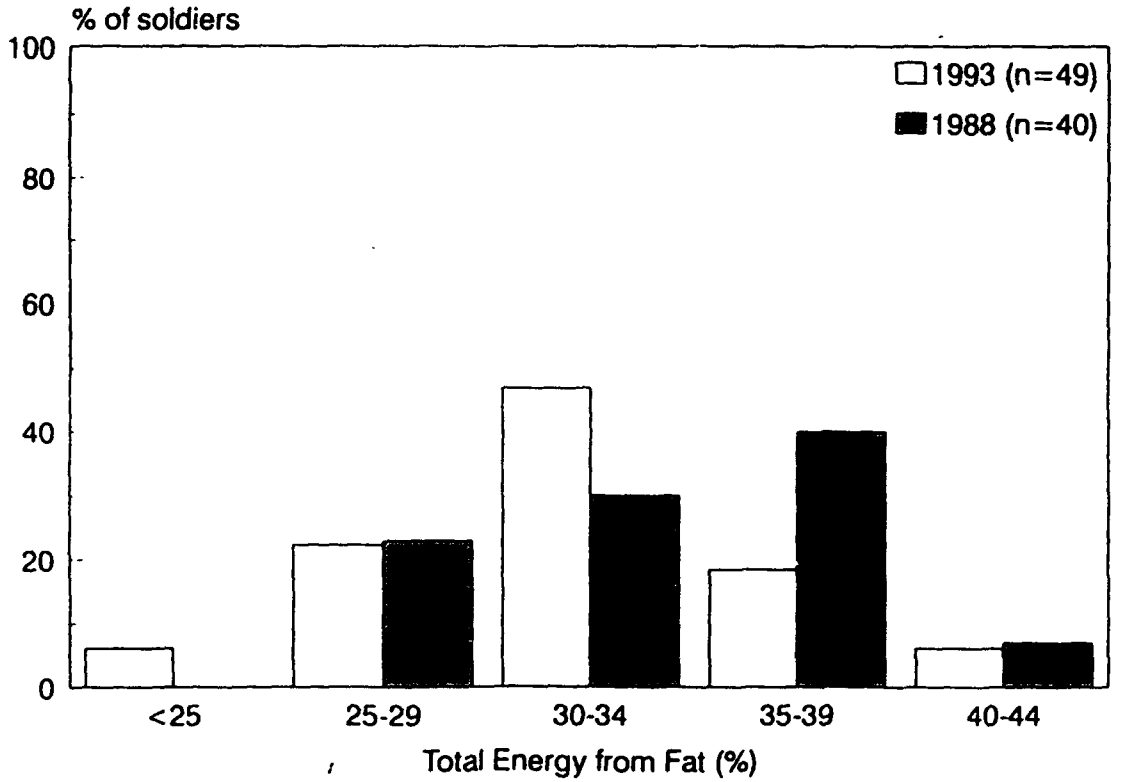
Macronutrient Distribution

Mean macronutrient distribution (i.e., mean percentage contribution to the mean energy intake from protein, fat, and carbohydrate) for the 1993 and the 1988 studies is shown in Table 8. The percentage of mean energy intake derived from fat in 1993 is less than that of 1988, reflecting the change in the menu macronutrient distribution (see Table 6). Likewise, the percentage of mean energy intake derived from carbohydrate was increased in 1993. Figure 4 depicts the distribution of soldiers obtaining specified percentages of food energy from fat for the two studies.

Table 8. Mean macronutrient distribution in 1993 and 1988 studies

Energy Distribution	1993 n = 49				1988 n = 40			
	Total	B	L	D	Total	B	L	D
% Protein	12	11	14	13	16	12	18	18
% Fat	32	29	32	32	34	29	33	39
% Carbohydrate	56	60	54	55	52	61	50	45

Figure 4. Soldiers obtaining specified percentages of food energy from fat



Assessment of Total Mean Nutritional Intakes

Table 9 shows a comparison between the MRDA (as established for female soldiers) and the mean nutritional intake for the various nutrients analyzed for the 1993 and 1988 studies. How close each nutrient level was to MRDA standards is also depicted as a relative percentage. Limitations of the 1988 nutrient database precluded analysis for several nutrients, such as vitamin B_6, folic acid, magnesium, zinc, and potassium. However, improvements in the database allowed analysis of these nutrients for the 1993 study. Due to these differences between the databases, mean nutritional intakes in 1993 appear worse than those in 1988, but this cannot be substantiated. For instance, the lowest mean intake in 1988 was 91% for calcium, while in 1993 it was 65% for folic acid. Although the mean energy intake in 1993 was 108% of the MRDA, these soldiers did not consume enough food to meet their MRDA for vitamin B_6, folic acid, calcium, magnesium, iron, and zinc, which were 76%, 65%, 73%, 89%, 90%, and 73% of their MRDA, respectively.

Table 10 shows the wide range in nutritional intakes during this study, indicating that some individuals' mean intakes were suboptimal. The inadequate intake of some individuals is more clearly depicted in Table 11, which presents the number of soldiers with mean nutritional intakes at selected levels of the MRDA (<60%, 60%-69%, 70%-79%, 80%-89%, 90%-99% and ≥ 100%) for 1993 and 1988.

Table 9. Mean nutritional intakes of female soldiers during BCT in 1993 and 1988

Nutrient	MRDA[1]	1993 n = 49	%MRDA	1988 n = 40	%MRDA
Energy, kcal	2000-2800	2592 ± 500	108	2467 ± 560	103
Protein, g	80	82 ± 18	103	96 ± 22	120
Fat, g	--[2]	94 ± 25	--	94 ± 34	--
Saturated Fat, g	--	30 ± 7	--	-[3]	-
Carbohydrate, g	--	365 ± 69	--	318 ± 74	--
Vitamin C, mg	60	89 ± 38	148	165 ± 117	275
Thiamin, mg	1.2	1.8 ± 0.4	148	2.0 ± 0.6	167
Riboflavin, mg	1.4	2.0 ± 0.6	144	2.2 ± 0.7	157
Niacin, mg	16	20 ± 5	128	27 ± 7	169
Vitamin B_6, mg	? 0	1.5 ± 0.5	76	-	-
Folic Acid, mcg	400	261 ± 74	65	-	-
Vitamin B_{12}, mcg	3.0	5.6 ± 4.9	187	3.7 ± 1.5	123
Vitamin A, IU	4000	6951 ± 6214	174	8450 ± 6690	211
Calcium, mg	800-1200	728 ± 321	73	907 ± 428	91
Phosphorous, mg	800-1200	1296 ± 339	130	1600 ± 392	160
Magnesium, mg	300	267 ± 69	89	-	-
Iron, mg	18	16.2 ± 3.5	90	18.4 ± 7.0	102
Zinc, mg	15	10.9 ± 2.6	73	-	-
Potassium, mg	--[4]	2681 ± 670	-	-	-
Sodium, mg	--[5]	3994 ± 819	--	4420 ± 1158	--
Cholesterol, mg	--[6]	466 ± 169	--	418 ± 219	--

Mean ± SD.

[1]Military Recommended Dietary Allowances for female soldiers, ages 17-50 years (Department of the Army, 1985).

[2]No MRDA established denoted by "--."

[3]Data not recorded denoted by "-."

[4]Estimated safe and adequate intake is 1875-5625 mg of potassium.

[5]Target for sodium is 1700 mg per 1000 kcal (i.e., 4080 mg for female soldiers).

[6]Suggested cholesterol maximum intake is 300 mg.

Table 10. Minimum and maximum nutrient intakes in 1993 (n=49)

Nutrient	MRDA[1]	Minimum	Maximum
Energy, kcal	2000-2800	1294	4388
Protein, g	80	29.9	131.8
Fat, g	--[2]	43	190
Saturated Fat, g	--	16	51
Carbohydrate, g	--	166	568
Vitamin C, mg	60	10	208
Thiamin, mg	1.2	0.7	2.9
Riboflavin, mg	1.4	0.9	3.6
Niacin, mg	16	6	43
Vitamin B_6, mg	2.0	0.4	3.1
Folic Acid, mcg	400	88	425
Vitamin B_{12}, mcg	3.0	1.3	23.8
Vitamin A, IU	4000	2271	35919
Calcium, mg	800-1200	380	1763
Phosphorous, mg	800-1200	602	2227
Magnesium, mg	300	106	506
Iron, mg	18	6.5	27.0
Zinc, mg	15	3.3	17.5
Potassium, mg	--[3]	1066	4547
Sodium, mg	--[4]	2055	6630
Cholesterol, mg	--[5]	145	763

[1]Military Recommended Dietary Allowances for female soldiers, ages 17-50 years (Department of the Army, 1985).
[2]No MRDA established denoted by "--."
[3]Estimated safe and adequate intake is 1875-5625 mg of potassium.
[4]Target for sodium is 1700 mg per 1000 kcal (i.e., 4080 mg for female soldiers).
[5]Suggested cholesterol maximum intake is 300 mg.

Table 11. Soldiers with mean nutritional intakes at selected levels of the MRDA[1]

Nutrient	1993 (n=49)						1988[2] (n=40)					
	Percent of MRDA						Percent of MRDA					
	<60	60-69	70-79	80-89	90-99	≥100	<60	60-69	70-79	80-89	90-99	≥100
Kilocalories	1	0	4	3	7	34	-	-	-	-	-	-
Protein	2	1	1	8	15	22	-	-	-	-	-	-
Vitamin C	4	1	1	5	1	37	0	1	0	0	0	39
Thiamin	1	0	0	1	0	47	-	-	-	-	-	-
Riboflavin	0	1	1	0	4	43	-	-	-	-	-	-
Niacin	1	0	0	1	6	41	0	0	0	0	1	39
Vitamin B_6	9	11	11	5	9	4	-	-	-	-	-	-
Folic Acid	20	12	6	7	2	2	-	-	-	-	-	-
Vitamin B_{12}	1	2	1	1	5	39	0	0	3	4	5	28
Vitamin A	3	0	3	5	5	33	0	1	1	0	0	38
Calcium	22	9	4	5	2	7	4	8	7	-[3]	-[3]	21
Phosphorus	0	1	1	2	2	43	-	-	-	-	-	-
Magnesium	4	3	7	15	6	14	-	-	-	-	-	-
Iron	2	3	7	12	10	15	0	0	5	10	5	20
Zinc	9	13	13	6	5	3	-	-	-	-	-	-

[1]Military Recommended Dietary Allowances for female soldiers, ages 17-50 years (Department of the Army, 1985); an average was used for those nutrients in which the MRDA is a range.

[2]Inadequate nutrient intakes noted only for vitamin C, niacin, vitamin B_{12}, vitamin A, and iron were reported in this format.

[3]Rose et al. (1989a) grouped calcium intakes differently than we did; therefore, their >1200 mg and 800-1200 mg groups are included under ≥ 100% in this table.

Reasons for Not Eating

The reasons for not eating are shown in Table 12. Of the 8012 food items selected by the soldiers, 569 were returned with 50% or more of the portion not being consumed. The reasons most commonly given were "not hungry" and being "full." In the 1988 study, the three reasons given most frequently were "no time," "full," and "don't like." Soldiers on both studies (1993 and 1988) had similar time allotted for

meal consumption and restrictions (no socialization) during meal times.

Table 12. Reasons given for not eating the entire portion of food

Reason for not eating	Frequency
Not hungry	150
Full	148
No time	129
Do not like	119
Cold	12
Sick	11
Saved for later	0
Dieting	0

CONTRIBUTIONS OF FOOD GROUPS TO NUTRITIONAL INTAKES

Comparisons between the 1993 and 1988 studies were performed to determine the food source contributors for energy, protein, fat, carbohydrate, sodium, and cholesterol. Food sources were also examined for those nutrients of particular importance for women, such as calcium, iron, vitamin B_6, and folic acid. Percentages have been rounded to the nearest whole number and, therefore, may not add up to 100%.

It was difficult to make exact comparisons between these studies because of differences between the classification of foods within the major food groups (i.e., minor food groups) used in 1988 and in 1993. (See Appendices E and G for the 1993 and 1988 major and minor food groups.) For instance, in 1988, although a separate major food group (combination dishes) was used to categorize casseroles or mixed food dishes, the results from this group (combination dishes) were pooled with those of the meat/entree group during the final analysis. In 1993, the combination dishes were kept separate from the meat group. Furthermore, in 1993, the legumes group included other legumes (baked beans, blackeyed peas, and lima beans) in addition to

peanut butter. A major difference between the 1993 and 1988 food groups is the categorization of condiments, beverages, and crackers and chips. While we included these food items under the "other" major food group in 1993, in 1988 there was a major food group for each of these categories.

Energy Food Sources

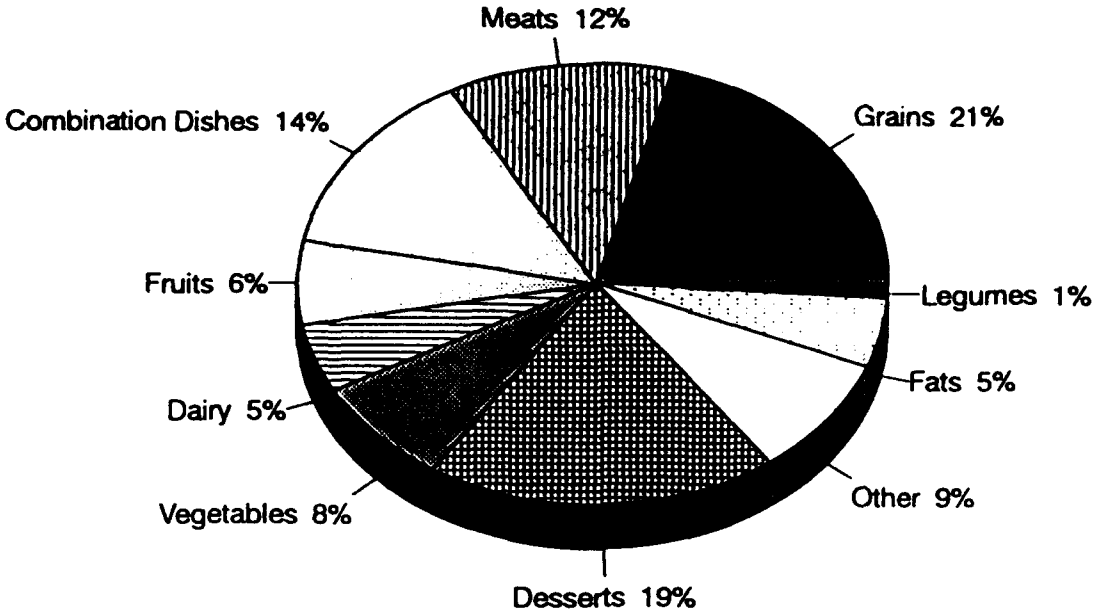
Figure 5 depicts the percentage contributions of food sources to energy intakes in 1993 and 1988. Foods from the grain group were the largest contributors to the total energy intake in 1993; at 21%, this percentage of the total intake was similar to the 22% grain group contribution in the 1988 study. If the combination group (14%) and the meat group (12%) are added together, the total contribution of 26% would be similar to that of the meat group in the 1988 study (27%). Interestingly, the dessert group comprised 19% of the total intake in 1993, more than doubling the 8% contribution in 1988. Meaningful decreases in consumption, as compared to 1988, were noted in two major food groups: dairy and fruit. In 1993, the dairy group contributed only 5% of energy intake (9% in 1988). Likewise, fruit consumption went from 11% in 1988 to 6% in 1993. Encouragingly, the fat and oils group comprised only 5% of the energy intake, down from 7% in 1988, and mean calories went up.

Protein Food Sources

Figure 6 depicts the percentage contributions of food sources to protein intakes in 1993 and 1988. Foods from the combination group contributed 28% of the total protein intake; 25% of the protein intake was accounted for by the meat group. The combined total of 53% is close to the 56% contributed by the meat group in 1988. Grains were the second largest contributor at 19%, as compared to 17% in 1988. The percentage of protein from the dairy group declined from 14% in 1988 to 11% in 1993. Table 13 further examines the meat group, indicating specific food sources of protein. Since the 1988 data includes the combination dishes in the meat group, we combined these two food groups to facilitate the comparison between the two studies.

Figure 5. Contributions of food groups to energy intakes in 1993 and 1988

1993



1988

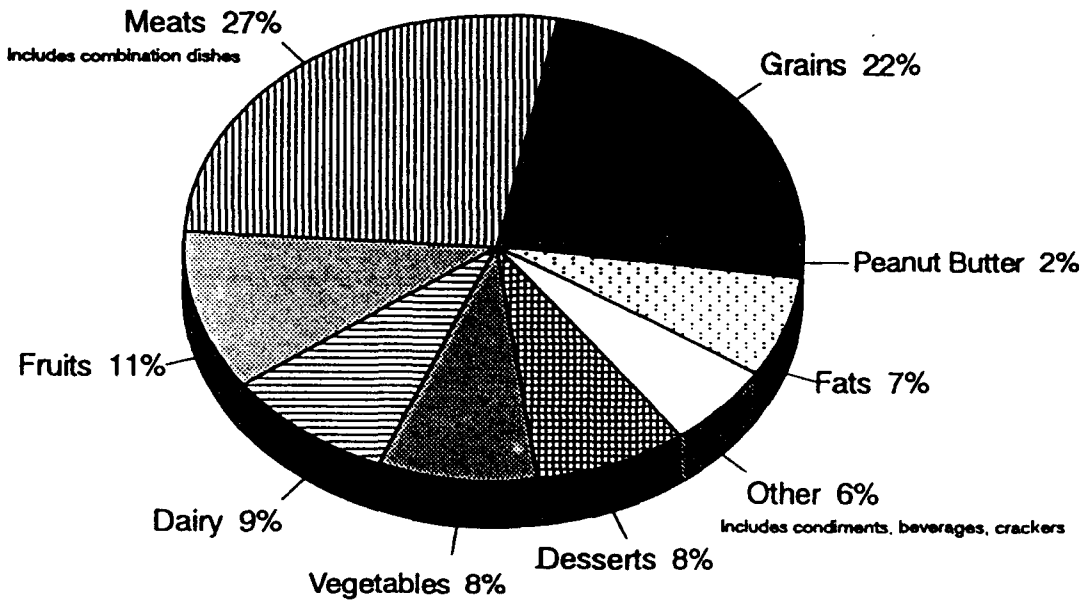


Figure 6. Contributions of food groups to protein intakes in 1993 and 1988

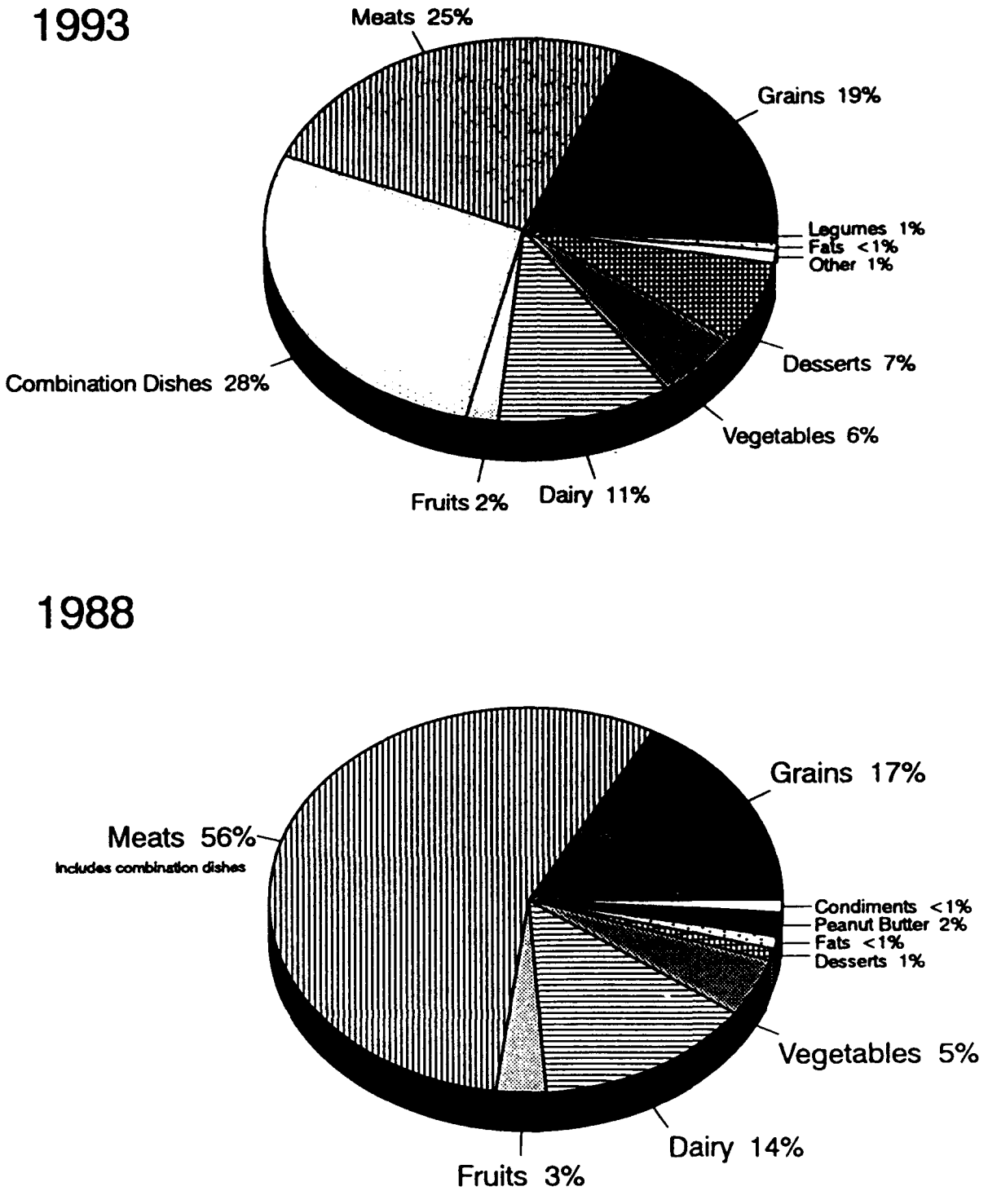


Table 13. Contribution of protein from meat group and combination dishes

Meat Group/Combination Dishes	1993 (n=49)	1988 (n=40)
Eggs	15%	7%
Bacon	3%	7%
Sausage	4%	6%
Beef	5%	15%
Soy Extended Beef	4%	3%
Veal	5%	6%
Pork	2%	11%
Chicken	4%	8%
Turkey	1%	7%
Fish	3%	7%
Cured Meats	<1%	5%
Combination Dishes	53%	18%

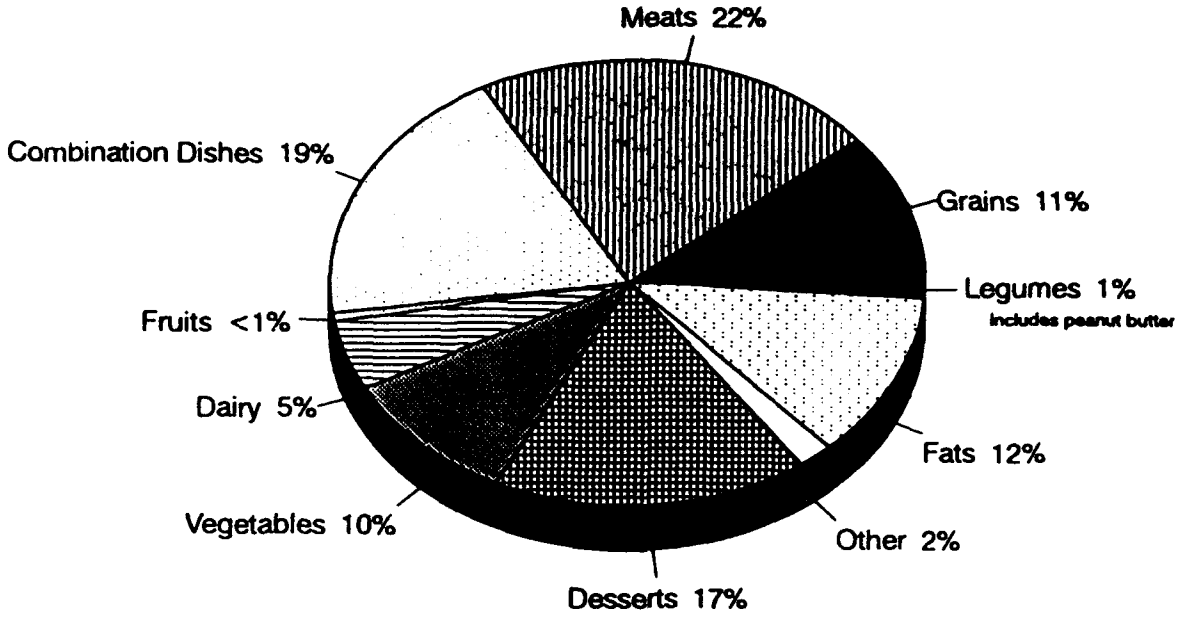
Fat Food Sources

Figure 7 depicts the percentage contributions of food sources to fat intakes in 1993 and 1988. The combination and meat groups provided a combined total of 41% of fat intake, comparable to 45% in 1988. Dairy contributed only 5% in 1993, while it contributed 10% in 1988. Foods from the fat and oils group decreased from 19% to 12%, while vegetables provided 10% of fat, increasing from 6% in 1988. Grains contributed 11% of total fat, comparable to the 9% in 1988.

Table 14 breaks the meat group down further, indicating specific food sources of fat. Since the 1988 data includes the combination dishes in the meat group, we combined these two food groups to facilitate the comparison between the two studies. Table 15 breaks the fat and oils group down indicating specific food sources of fat for both studies.

Figure 7. Contributions of food groups to fat intakes in 1993 and 1988

1993



1988

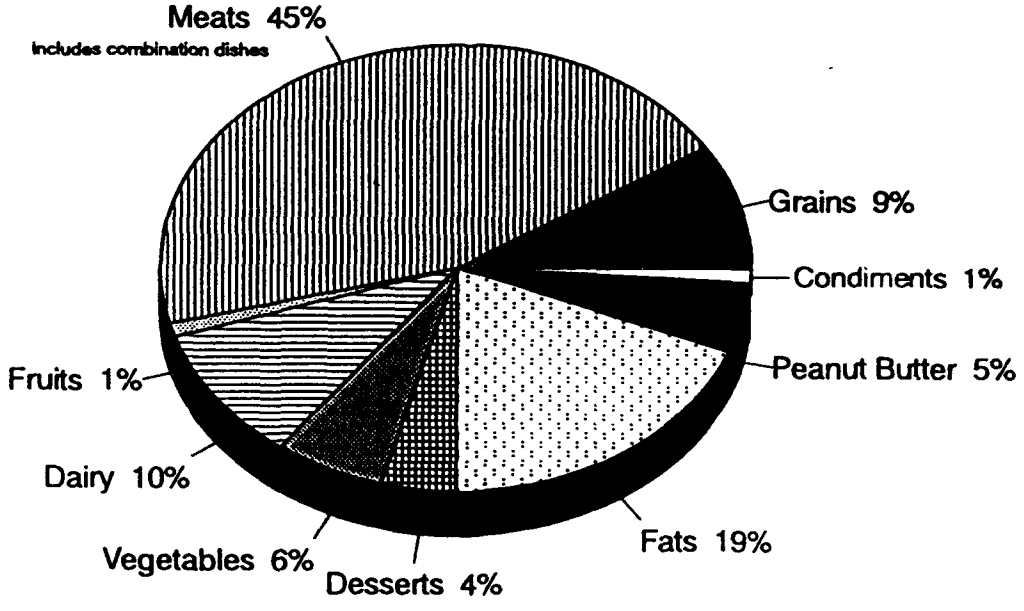


Table 14. Contribution of fat from meat group and combination dishes

Meat Group/Combination Dishes	1993 (n= 49)	1988 (n=40)
Eggs	18%	10%
Bacon	6%	14%
Sausage	7%	14%
Beef	4%	7%
Soy Extended Beef	4%	3%
Veal	5%	10%
Pork	2%	10%
Chicken	5%	8%
Turkey	<1%	3%
Fish	3%	3%
Cured Meats	<1%	6%
Combination Dishes	45%	13%

Table 15. Contribution of fat from fat and oils group

Fat and Oils Group	1993 (n=49)	1988 (n=40)
Margarine	44%	58%
Salad Dressing	14%	31%
Gravy	37%	10%
Non-Dairy Creamer	4%	-

Carbohydrate Food Sources

Figure 8 depicts the percentage contributions of food sources to carbohydrate intakes in 1993 and 1988. Food items from the grains, desserts, fruits, vegetables, and legume groups contributed 71% of the total carbohydrate intake. The grains group contributed the highest amount of the carbohydrate intake at 27%. Desserts,

however, followed with a close second at 24%. Fruits and vegetables were similar at 10% and 9%, respectively, with legumes contributing only 1% of carbohydrate intake. When making comparisons with the 1988 intakes, the dessert and fruit groups are of particular interest; dramatic changes were measured in both groups. Desserts comprised 12% of the carbohydrate intake in 1988; this increased to 24% in 1993. The contribution of the fruit group to the total carbohydrate intake showed a corresponding decrease, down from 22% in 1988 to 10% in 1993.

Sodium Food Sources

Figure 9 depicts the percentage contributions of food sources to sodium intakes in 1993 and 1988. Major sodium contributors were grains (27% in 1993 and 31% in 1988) and meats (including combination dishes: 34% in 1993 and 33% in 1988). Although the sodium contribution from these and other (vegetables and fat) groups had decreased, the desserts contribution increased from 2% in 1988 to 10% in 1993, due to an increase of dessert consumption. Of the total sodium intake, salt added to the food by soldiers at the table accounted for 1.7% in 1993, while it was 4% in 1988.

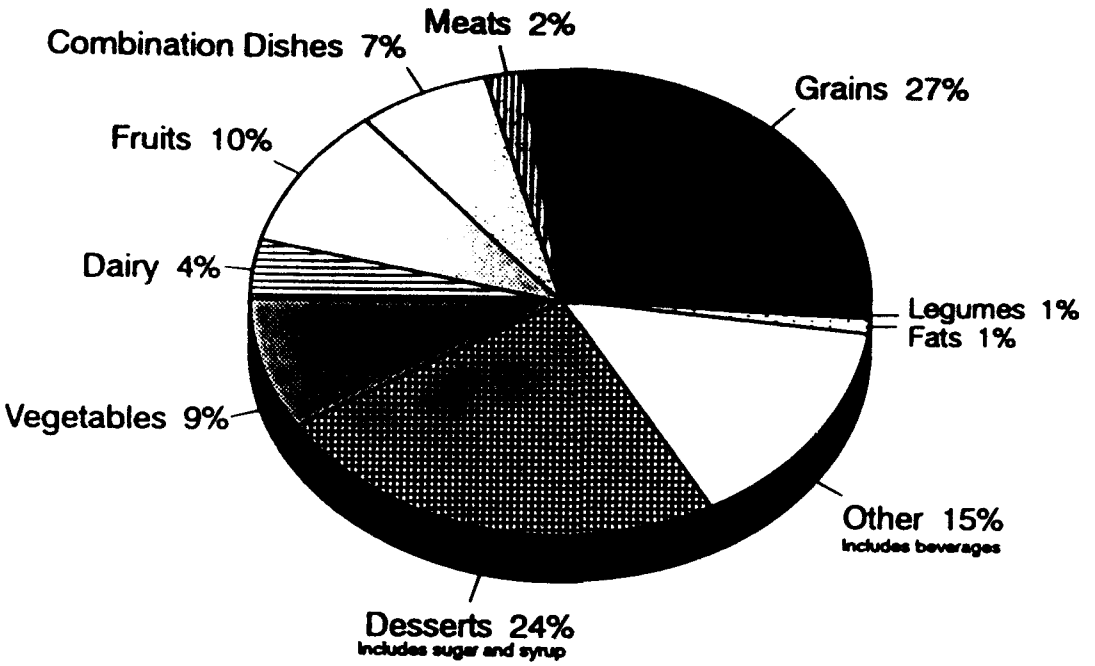
Cholesterol Food Sources

Figure 10 depicts the percentage contributions of food sources to dietary cholesterol in 1993 and 1988. The meat groups (including the combination dishes), which included eggs and breakfast meats, were the major cholesterol contributors in both studies (67% in 1993 and 79% in 1988). The grains group, which included French toast, pancakes, and waffles, contributed 15% of cholesterol in 1993, while it contributed only 11% in 1988. The cholesterol contribution from the dairy group decreased from 11% in 1988 to 5% in 1993.

Table 16 shows the distribution of dietary cholesterol intakes at breakfast, lunch, and dinner for both studies. Intakes of dietary cholesterol were greater at breakfast for both studies. However, in 1993, the breakfast contribution was larger than in 1988 (57% and 43%, respectively).

Figure 8. Contributions of food groups to carbohydrate intakes in 1993 and 1988

1993



1988

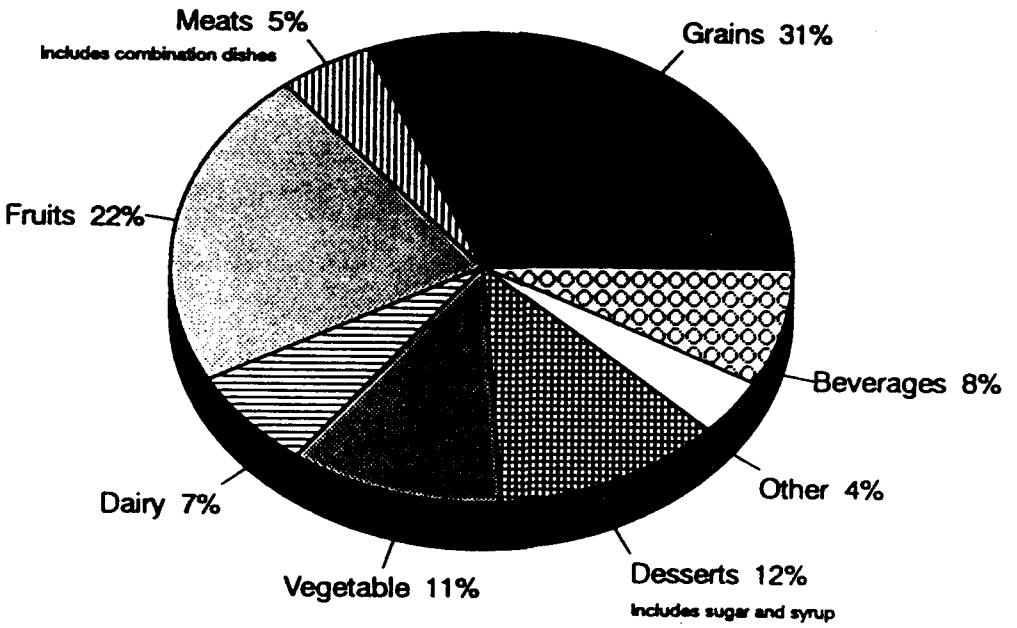
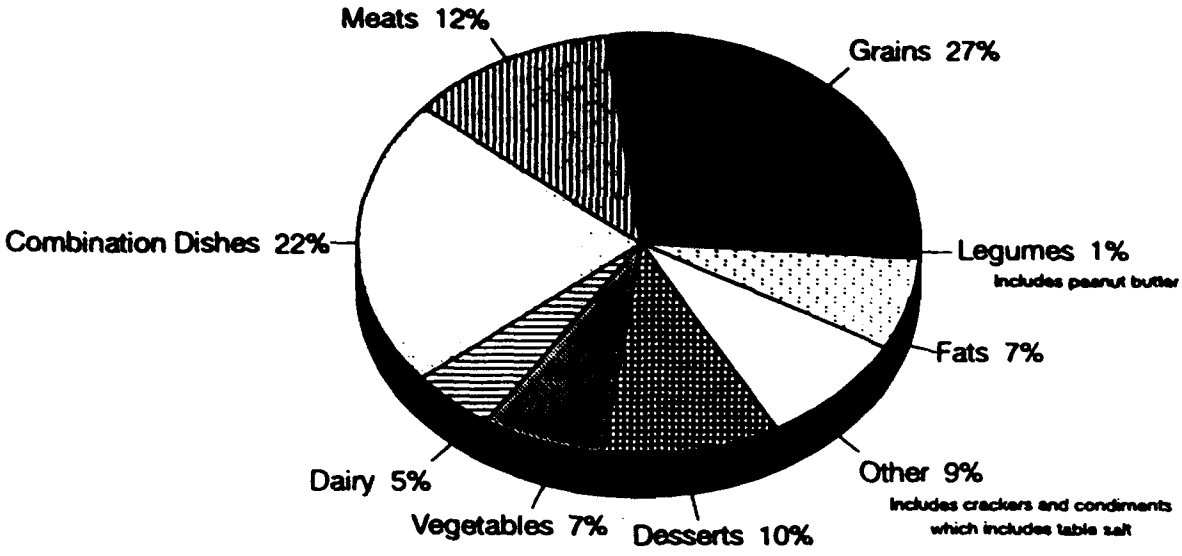


Figure 9. Contributions of food groups to sodium intakes in 1993 and 1988

1993



1988

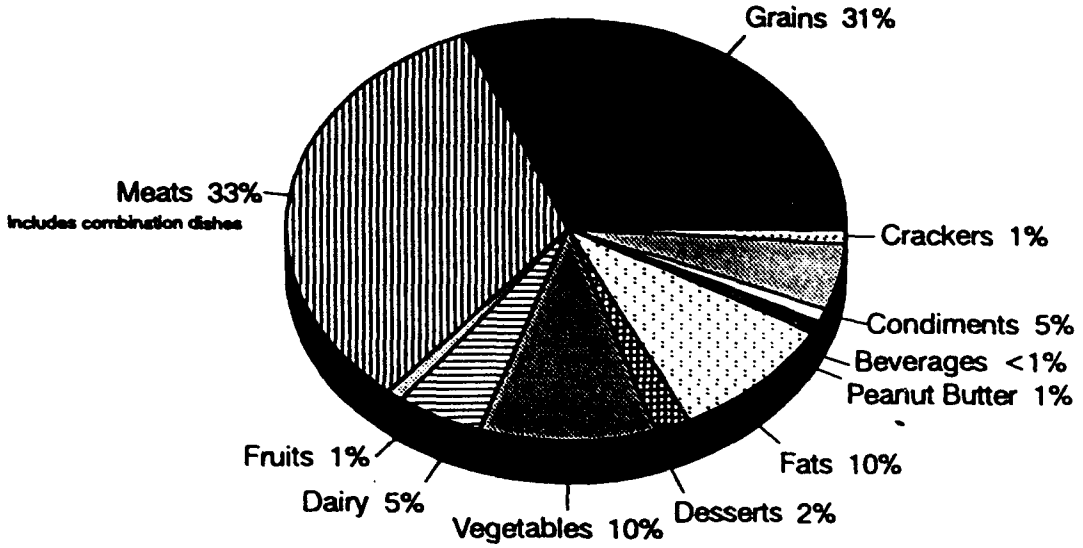
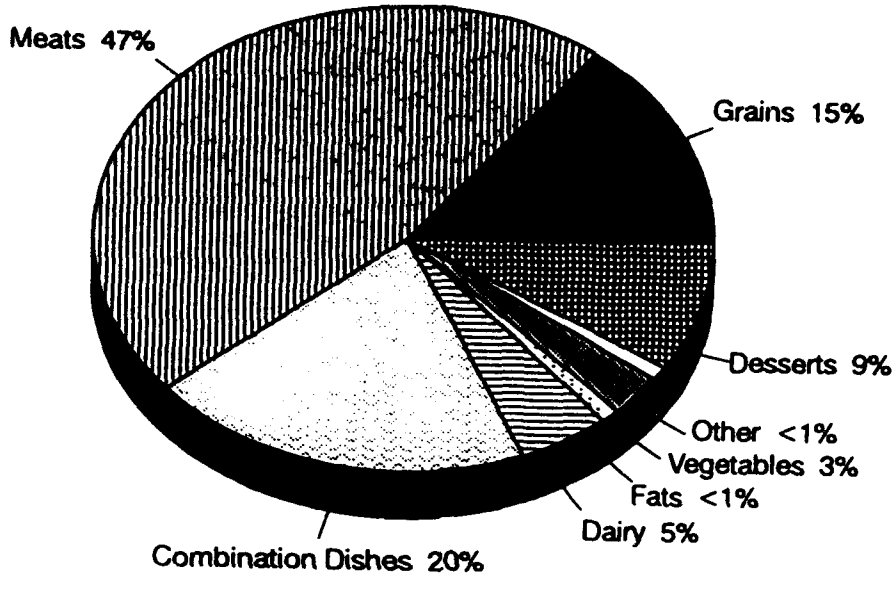


Figure 10. Contributions of food groups to dietary cholesterol in 1993 and 1988

1993



1988

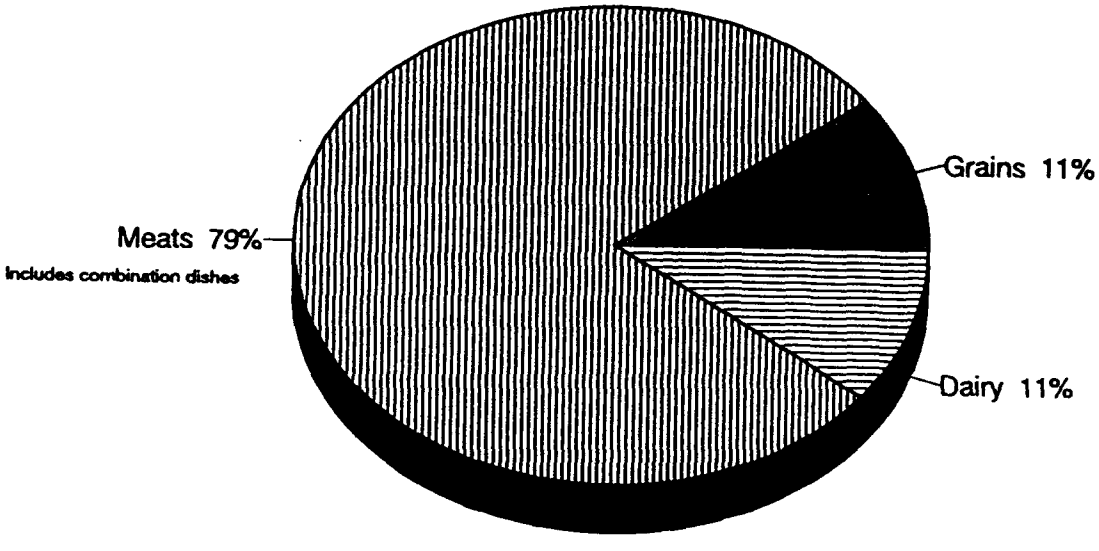
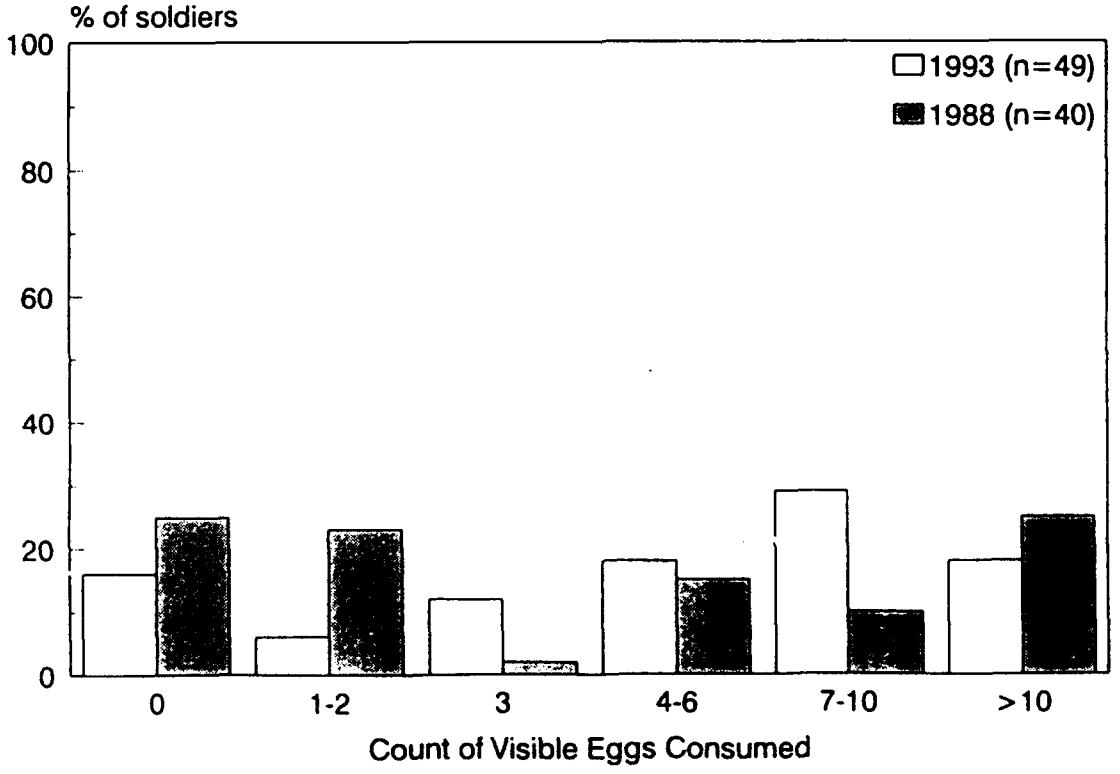


Table 16. Percentage of dietary cholesterol contributed by each meal in 1993 and 1988

Meal	1993 (n=49)	1988 (n=40)
Breakfast	57%	43%
Lunch	21%	29%
Dinner	22%	29%

Figure 11 shows the count of visible eggs consumed during the 7-day period in 1993 and 1988. The number of soldiers consuming more than three eggs per week increased from 50% in 1988 to 64% in 1993. Since eggs are mainly consumed at the breakfast meal, the increase in egg consumption may explain the increased breakfast cholesterol as well as the increase in total dietary cholesterol intake (466 mg in 1993 versus 418 mg in 1988; see Table 9). In 1988, 39% of the total dietary cholesterol was contributed by visible eggs; yet, in 1993, visible eggs accounted only for 35% of the total dietary cholesterol. However, when adjusting the egg cholesterol values to the 1988 data base (in 1989, USDA updated the nutrient data base lowering the egg cholesterol), in 1993, the visible eggs contributed 43% of the total cholesterol.

Figure 11. Soldiers consuming specified amounts of visible eggs in seven days



Vitamin B_6 and Folic Acid Food Sources

Figure 12 shows the percentage contribution of food sources to vitamin B_6 and to folic acid intakes in 1993. The major vitamin B_6 contributor was meat group/ combination dishes (39%). The major contributors of folic acid were meat group/ combination dishes (28%) and grains (27%).

Calcium and Iron Food Sources

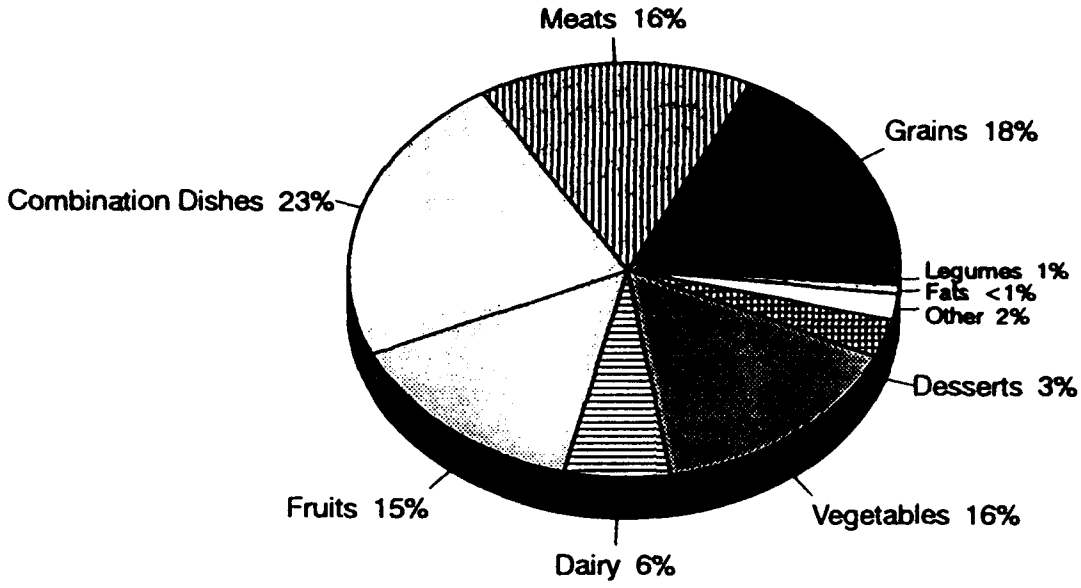
Figure 13 shows the percentage contribution of food sources to calcium and to iron intakes in 1993. The major calcium contributors were dairy (30%) and grains (20%). Mean calcium intake decreased from 907 mg in 1988 to 728 mg in 1993. Only 5 out of 49 soldiers (10.2%) reported getting an upset stomach after drinking milk. Table 17 shows the percentage of soldiers who reported liking or disliking milk, cheese, and yogurt.

The major contributors of iron were grains (36%) and meat group/combination dishes (33%). Mean iron intake decreased from 18.4 mg in 1988 to 16.2 mg in 1993. Table 17 shows the percentage of soldiers who reported liking or disliking liver, red meat, and eggs.

To determine if variation in fat intake affected calcium and iron intakes, their mean intakes were examined at different levels of fat intake. These results are presented and compared with 1988 data in Table 18.

Figure 12. Contributions of food groups to vitamin B_6 and folic acid intakes in 1993

Vitamin B_6



Folic Acid

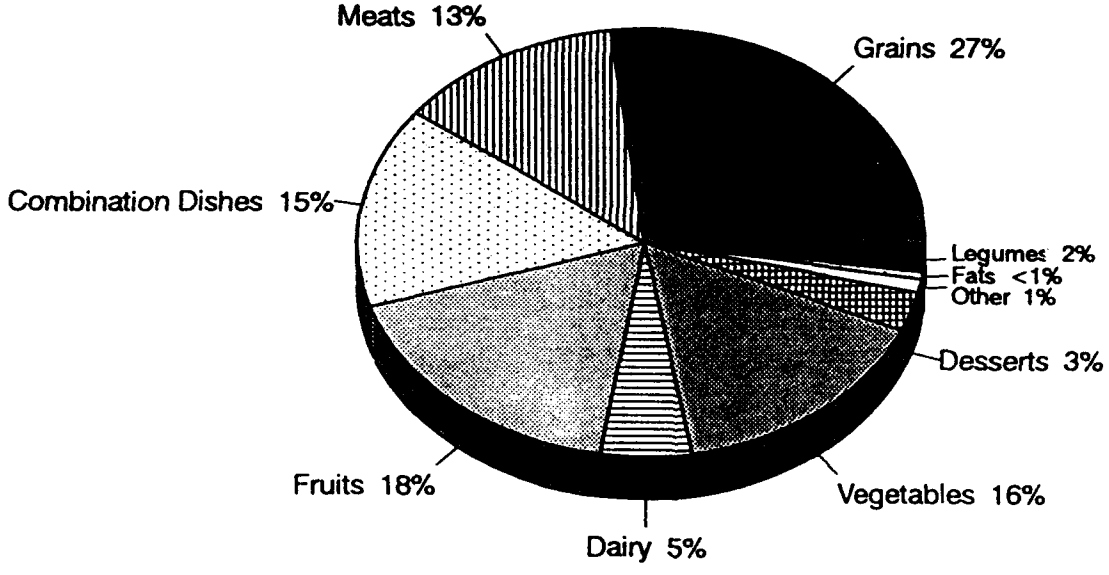
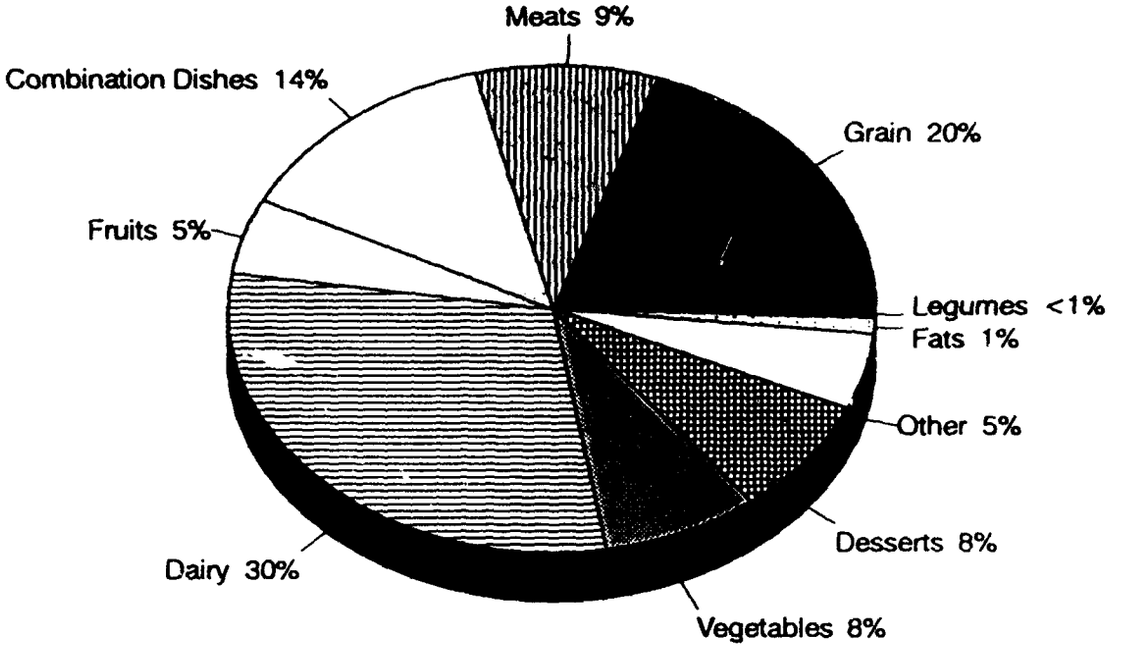


Figure 13. Contributions of food groups to calcium and iron intakes in 1993

Calcium



Iron

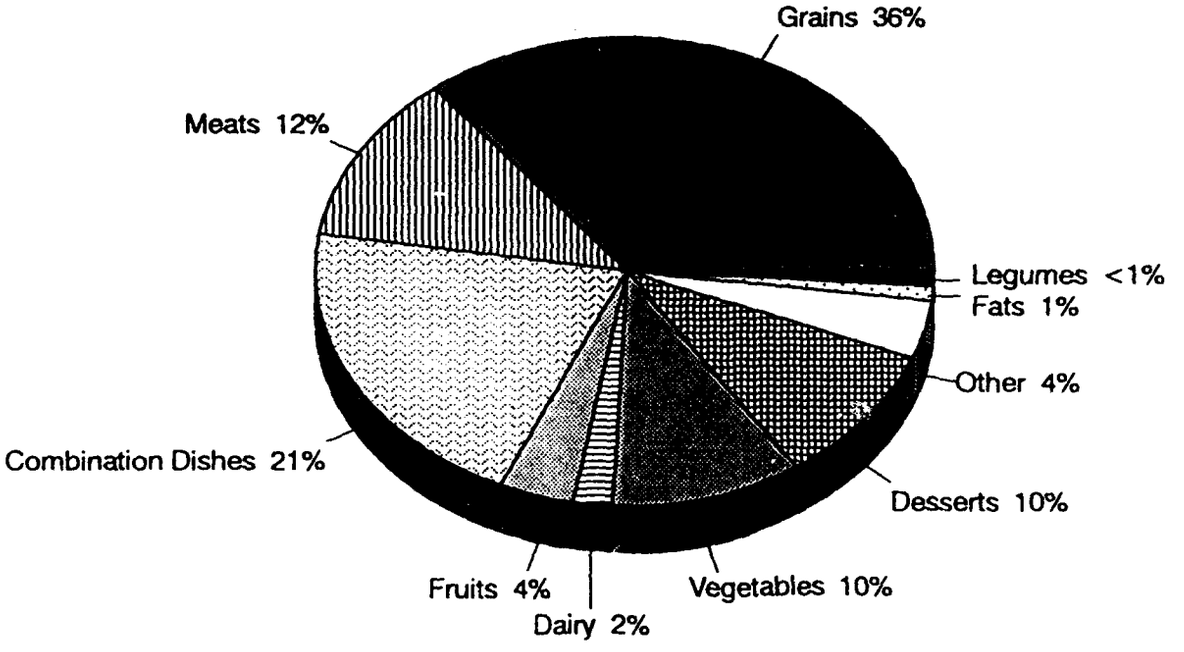


Table 17. Percentage of soldiers reporting liking or disliking certain foods

Food	Like[1]	Neutral[2]	Dislike[3]	Never tried
Milk	71.4	16.3	12.2	0
Cheese	79.6	16.3	4.1	0
Yogurt	49.0	24.5	16.3	10.2
Liver	24.5	8.2	55.1	12.2
Red Meats	61.2	22.4	12.2	4.1
Eggs	57.1	32.7	10.2	0

n=49
[1]Includes "like extremely," "like very much," and "like moderately."
[2]Includes "like slightly," "neither like or dislike," and "dislike slightly."
[3]Includes "dislike extremely," "dislike very much," and "dislike moderately."

Table 18. Mean calcium and iron intakes at different levels of fat intake

Nutrient	%Fat[1]	1993		1988	
		n	Mean ± SD	n	Mean ± SD
Calcium (mg)	25-29%	14	879 ± 349	9	746 ± 394
	30-34%	23	659 ± 278	12	866 ± 321
	35-39%	9	718 ± 368	16	977 ± 496
	>40%	3	590 ± 225	3	858 ± 302
Iron (mg)	25-29%	14	15 ± 3	9	17.9 ± 8.5
	30-34%	23	17 ± 3	12	18.5 ± 7.8
	35-39%	9	18 ± 4	16	17.8 ± 6.4
	>40%	3	12 ± 5	3	17.5 ± 4.6

[1]Dietary fat as percentage of energy provided.

In 1988, female soldiers' mean calcium intakes at the 25%-29% fat energy never attained the lower limit of the MRDA for calcium. However, in 1993, females consuming that level of fat had a higher mean calcium intake than those consuming higher amounts of fat. On the other hand, those soldiers consuming 35%-39% fat energy were the only ones that had an optimal mean iron intake. An extremely high

fat diet (> 40% fat energy) appeared to have adversely affected the intake of calcium and iron in the 1993 study; however, this was not seen in the 1988 study.

NUTRITION INITIATIVES: FIVE-YEAR PROGRESS

Table 19 summarizes the 1988 and 1993 female soldiers' nutritional intake data depicting the Military Nutrition Initiatives' five-year progress.

Table 19. Nutrition Initiatives: 1988 versus 1993 female soldiers' nutritional intakes

	1988 n=40	1993 n=49
Energy/kg of body wt (kcal)	41.7	41.0
Mean energy intake (kcal / %MRDA)	2467 / 103	2592 / 108
Nutrients with mean intake < 100% MRDA	Ca[1]	vitamin B_6, folic acid, Ca, Mg, Fe, Zn
Percent of total kcal (%)		
Protein	16	12
Fat	34	32
Carbohydrate	52	56
Soldiers with energy fat intake (%)		
<25%	0	6
25-29%	23	22
30-34%	30	47
35-39%	40	18
40-44%	7	6
Mean cholesterol intake (mg)	418	466
Mean sodium intake (mg)	4420	3994

[1]Limitations of the 1988 database precluded analysis of several nutrients, such as vitamin B_6, folic acid, magnesium, zinc, and potassium.

FIELD FEEDING ISSUES

During BCT, the soldiers participated in a 4-day Field Training Exercise (FTX), where the soldiers received two A-Rations and one Meal, Ready-To-Eat (MRE) per day, but nutrient intake data were not collected during the FTX. The A-Ration meals were prepared in the garrison kitchen facility and transported to the field in insulated

food containers. Upon their return from the field, the Field Feeding Questionnaire was administered to all the soldiers in the training unit. Table 20 contains the soldiers' responses. Approximately 86% of the soldiers reported eating less in the field than in the dining facility. The main reason (62.7% of soldiers) provided for this change in eating habits during the FTX was "the food did not look good."

Table 20. Field feeding issues during BCT Field Training Exercise

Question	Percentage of soldiers (n = 153)
Compare field intake with dining hall intake:[1]	
Ate less	85.5
Ate the same	7.2
Ate more	5.9
I do not know	1.3
Field intake was less because:	
The food did not look good.	62.7
I was not hungry.	49.7
The food's temperature was not right.	38.6
I was not feeling well.	32.7
My hands were not clean.	24.8
I wanted to lose weight.	16.3
I was not given enough time to eat.	15.7
I do not like to be told what to eat.	13.7
I did not want to have to go to the bathroom.	11.8
The weather was bad.	11.8
It was not my usual mealtime.	5.9
I had menstrual cramps.	5.2
I was not eating with my friends.	0.7

[1]One soldier (0.7%) did not answer this question.

NUTRITION KNOWLEDGE

Nutrition knowledge was not significantly different between the female soldiers that entered BCT in 1988 (n=37) and those that entered BCT in 1993 (n=49). From the 21 nutrition knowledge questions (Appendix H), the total mean scores were 13.5 ± 2.6 and 13.9 ± 2.5 (mean ± SD) for the 1993 and 1988 groups, respectively. These scores represent a mean percentage of correct responses of 64.3 ± 12.2% and 66.0 ± 12.0%, respectively. Table 21 compares the percentage of correct responses from the 1993 and 1988 assessments. In general, the responses in 1993 were similar to the responses in 1988.

Table 22 shows the percentage of soldiers in the 1993 and the 1988 studies making the correct choice to each of the nutrition belief and food choice questions of the Nutrition Knowledge Questionnaire. The percentage of soldiers who chose the correct answer in the first question (foods to choose to help them practice good nutrition) was high, ranging from 83.7% to 100% in 1993 and from 73.1% to 96.6% in 1988. The mean percentage of soldiers responding with the correct answer for this question was 93.9 ± 5.5% and 89.3 ± 7.7% (mean ± SD) for 1993 and 1988, respectively. In spite of the high percentage of correct responses for this question, when the soldiers were asked to make a choice ("If given a choice between the food in column A or the food in column B, which would you choose?"), the percentage of soldiers who chose the more nutritious food was much lower, ranging from 55.1% to 73.5% in 1993 and 32.8% to 59.7% in 1988. Overall, a higher percentage of the 1993 soldiers made the right choice compared to those made by soldiers five years ago and the mean percentage of soldiers choosing the correct answer was significantly higher (p=0.48) in 1993 than in 1988 (61.9 ± 7.3% and 50.2 ± 10.3% for the 1988 and the 1993 soldiers, respectively).

Table 21. Comparison of 1988 and 1993 nutrition knowledge

Question	Percent of soldiers with correct responses	
	1993 (n=49)	1988 (n=37)
Q1 Fast foods are high in salt/fat	63	72
Q2 Calcium helps build bones/teeth	98	96
Q3 Protein is found in meat/fish/poultry	94	87
Q4 Carbohydrates are found in grains	45	37
Q5 Lean meats are good source of B vitamins	37	35
Q6 Iron is found in whole grains/red meats	47	41
Q7 Low-fat milk has...	47	57
Q8 Fat gives most energy per ounce	10	8
Q9 Fish is in the same group as chicken	90	98
Q10 Broiled fish is best choice for a reducing diet	92	90
Q11 Baked potato is the food lowest in salt	47	65
Q12 2000 kcal is the daily need of young women	39	61
Q13 Steak is not a good source of fiber	55	40
Q14 Four major food groups...	78	83
Q15 Water is essential...	98	97
Q16 Fat has more calories...	76	61
Q17 It is not necessary to take vitamin pills...	96	96
Q18 Ingredients listed on food labels are arranged...	69	66
Q19 You need more calories when physically active	88	77
Q20 Ice cream is a good source of calcium	63	66
Q21 Margarine does not have less calories...	20	28

Table 22. Comparison of the 1993 and 1988 nutrition beliefs and food choices

Question	Percent of soldiers making correct choice	
	1993 (n=4)	1988 (n=37)
Foods to practice better nutrition		
Butter vs. margarine	83.7	73.1
Whole vs low-fat milk	89.8	89.9
Sodas vs. unsweetened juice	100.0	94.1
Fried vs. baked foods	98.0	91.6
Salt vs. herbal seasoning	95.9	92.4
Pastries vs. fresh fruits	95.9	96.6
Chicken with or without skin	93.9	87.4
Hypothetical consumption choices		
Fried vs. baked chicken	61.2	47.1
High vs. low calorie food	65.3	59.7
Whole vs. low-fat milk	63.3	58.0
Buttered vs. nonbuttered vegetables	53.1	46.2
Cakes/pies vs. fresh fruits	73.5	57.1
Potatoes with or without gravy	55.1	32.8

DISCUSSION

Of the ten leading causes of death in the United States (heart diseases, cancers, strokes, unintentional injuries, chronic obstructive lung diseases, pneumonia and influenza, diabetes mellitus, suicide, chronic liver disease and cirrhosis, and atherosclerosis), five have been associated with diet (coronary heart disease, some types of cancer, stroke, diabetes mellitus, and atherosclerosis) and another three (cirrhosis of the liver, accidents, and suicide) have been associated with excessive alcohol intake (DHHS, 1988). Furthermore, high blood pressure, obesity, dental diseases, osteoporosis, and gastrointestinal diseases are attributed to dietary

excesses and imbalances. The heightened awareness of nutrition related health issues generated several Department of the Army Military Nutrition Initiatives, which are consistent with national health objectives. Since 1985, the U.S. Army has introduced nutrition initiatives into the Armed Forces Recipe Service (Department of the Army, 1989), the Army Master Menu (Department of the Army, 1993), and the Army Food Service Program (Department of the Army, 1989) in an attempt to provide soldiers with diets lower in fat, cholesterol, and sodium.

During the intervening five years between 1988 and 1993, there were significant improvements in the menu provided at Fort Jackson, S.C. Energy provided by fat was reduced from 38% to 33% (energy from saturated fat in 1993 was 10%), while energy provided from carbohydrate was increased from 50% to 56%. These changes align the menu with the current MRDA, which recommends 50% to 55% carbohydrate, 10% to 15% protein, and ≤35% fat (Department of the Army, 1985), and the Military Nutrition Initiatives goals of providing no more than 30% of energy from fat (no more than 10% of energy from saturated fat) by 1998 (CMNR, 1991). The decrease in fat could have been related to the fact that only 1% low-fat milk was used, both in bulk containers and in recipes.

The 1993 menu also was lower in dietary cholesterol than the 1988 menu (928 mg versus 1299 mg). However, 928 mg remains considerably higher than the recommended goal of 300 mg set by the Military Nutrition Initiatives (CMNR, 1991). Undoubtedly, all the menu manipulations that decreased dietary fat also aided in decreasing dietary cholesterol, but some of the decrease in cholesterol was due to a lower cholesterol value for eggs in 1993 than in 1988 due to a USDA database update in 1989. It is unrealistic to expect a 300 mg dietary cholesterol intake while whole eggs are provided daily on the menu. Mixing egg whites with whole eggs to make scrambled eggs and omelets may be a feasible alternative to further lower dietary cholesterol.

Furthermore, the 1993 menu was lower in sodium content than the 1988 menu. This reduction in sodium content from 1731 mg/1000 kcal in 1988 to 1640 mg/1000 kcal brought the menu within the target of an average of 1700 mg/ 1000 kcal for

military food service systems as a safe and adequate level of sodium (Department of the Army, 1985).

Nutritional surveys of actual food consumption are crucial to the quantitative determination of food intake and assessment of nutritional status of troops, because the soldiers pick and choose the meal components they eat based on their food preferences. Therefore, serving an adequate menu does not necessarily mean that an adequate diet is consumed. There are several ways in which a nutritional survey can be conducted: food weighing, food records, or visual estimation. The most accurate method of collecting individual dietary intake data is the actual weighing of all food items before and after consumption. This method is not feasible for military nutrition surveys because data collection would unduly interfere with traffic flow in the dining facility and would infringe on soldier "space" and mealtime allotment. In addition, weighing food intake may interfere with usual dietary practices if the soldier refuses food selections to avoid waiting to have the item weighed. Estimated food records, in which subjects record foods and amounts they eat on each day of the study, are relatively easy to administer and minimally interfere with training schedules. The main disadvantage of this method is the inability of volunteer subjects to estimate portion sizes of food accurately. Food intake tends to be underestimated when food consumption is high and overestimated when food consumption is low (Americans may..., 1991). Furthermore, food records are often lost, misplaced, or not fully completed by subjects, thus requiring them to recreate the food records from memory. The modified visual estimation method has been used in a number of dietary surveys undertaken in garrison dining facilities (Schnakenberg et al., 1987). For soldiers consuming most of their foods in the dining facility, this method has an accuracy that is similar to the weighing method and is appropriate for the estimation of individual dietary intakes. Aside from the two minutes that the subject spends with the data collector, this method involves minimal subject burden. Furthermore, if location and space allocation for data collectors are adequate, there is minimal disruption of traffic flow in the dining facility.

The visual estimation method was used in both the 1993 and 1988 nutritional assessments (Rose et al., 1987; Schnakenberg et al., 1987). In general, the macronutrient distribution of the mean nutritional intakes reflected the menus'

macronutrient distributions. Therefore, for 1993, this was within the MRDA (Department of the Army, 1985) and the Military Nutrition Initiatives guidelines (CMNR, 1991).

In spite of a reduction in fat energy intake from 34% in 1988 to 32% in 1993, mean dietary cholesterol intake in 1993 was 466 mg/d, approximately 12% (48 mg/soldier/day) higher than in 1988. Considering that, in 1989, USDA updated the nutrient database lowering the cholesterol value of eggs from 548 mg/100 g to 422 mg/100 g, these 466 mg in 1993 would be equivalent to approximately 504 mg if the old database was used to provide a more direct comparison with the 1988's 418 mg. This increase in dietary cholesterol was mainly due to the number of visible eggs consumed in 1993, which offset the decrease in dietary cholesterol contributed by the dairy group (10% in 1988 versus 5% in 1993). (Although some of the decrease in dietary cholesterol intake from dairy foods can be attributed to the use of lower fat milk, this decrease could have been due to the decrease in dairy food intake instead.) Therefore, it is evident that nutrition education programs need to stress moderation in egg consumption and emphasize low cholesterol breakfast alternatives.

Mean sodium intake decreased from 1792 mg/1000 kcal in 1988 to 1541 mg/1000 kcal in 1993, which is well within the guidelines of 1700 mg/1000 kcal. This decrease was mainly due to a decrease in table salt usage (4% in 1988 versus 1.7% in 1993); 65.3% of the soldiers reported following a low salt diet.

Data from the few military nutritional surveys that included soldiers of both genders suggest that the nutritional intake of female soldiers is adequate when this intake occurs in the dining facility (rather than in a field setting) (Table 2). Our results are inconsistent with those reports, indicating suboptimal nutritional intakes in a dining hall setting (Table 9). This divergence may be due to the improvements in nutrient databases or to the differences in age and education of the soldiers in each study. In either case, our results indicate the potential for nutritional deficiencies among young female recruits.

According to the National Nutrition Monitoring System (NNMS) reports (LSRO, 1989), American women's intakes of vitamin E, vitamin B_6, folic acid, calcium,

magnesium, iron, and zinc are lower than the Recommended Dietary Allowances (RDA) (NRC, 1989), in spite of adequate food and nutrient supply (except iron) in the United States. Our results show a suboptimal intake of these nutrients as well. Because of the physical demands imposed by military training and the importance of nutrition on physical performance, the deficit of these nutrients in military women is of particular concern.

The menu served in U.S. Army dining facilities is detailed in the Master Menu (Department of the Army, 1993). Consisting of three fairly equal-size meals, the menu is designed to meet the energy and nutritional requirements of both male and female soldiers. However, the nutrient density of the menu is not always sufficient to provide for the increased nutritional requirements of the female soldier. The nutrient density of the menu provided during our study confirms these menu deficits, and the mean intakes of the female soldiers support the existence of the potential for nutritional deficiencies. Specifically, for a female soldier to meet her nutritional requirements, she would have to consume more than her energy requirement. This was evident in our results, which showed that although energy intake was adequate (108% of MRDA mid-point; body weight before [63.4 ± 9.2 kg] and after [64.2 ± 7.9 kg] the 8-week training was similar [Westphal et al., in press]), the intake of several nutrients (vitamin B_6, folic acid, calcium, magnesium, iron, and zinc) was not. The main two reasons given for not eating (not hungry and full) suggest that females may not be able to consume the same volume of food as males. Considering the nutrient density of the menu of the current study, it would have been difficult for these soldiers to consume the necessary amount of energy to meet all their nutritional requirements, without gaining weight. Thus, the nutritional problems of the military woman may be related to the need to meet body-weight standards as mandated by the U.S. Army Weight Control Program (Department of the Army, 1994).

Even though mean nutritional intakes in our study were marginal at worst, some soldiers had mean intakes of less than 60% of the MRDA, which could put them at nutritional risk. Of particular importance were the 22 out of 49 soldiers who had < 60% of the MRDA for calcium and the 20 out of 49 soldiers who had < 60% of the MRDA for folic acid.

Most adults do not consume enough calcium to meet their nutritional requirements, but women tend to be at greater risk because of aesthetics (desire to stay thin) and hormonal changes during the life cycle. Calcium is essential for bone density, nerve conduction, and muscle function. Calcium helps reduce the risk of stress fractures and of osteoporosis through promoting maximum peak bone mass. Inadequate calcium intake during the first three decades of life has been associated with an increased risk of osteoporosis later in life (Heaney, 1988). Mean calcium intake decreased from 907 mg in 1988 to 728 mg in 1993. This was probably due to a decrease in dairy product consumption (energy provided by the dairy group was 9% in 1988 and only 5% in 1993). If the cause for reduction in the consumption of dairy products was because of food allergies or food preferences (organoleptic), this is not known. However, the data suggest these were not problems, since only 10% of the soldiers reported getting an upset stomach after drinking milk, and most of the soldiers reported liking milk (71.4%) and cheese (79.6%) (Table 17). An attempt to decrease energy intake could have caused the decrease in dairy food consumption. Although 69.4% of the soldiers reported that they were trying to lose weight, only 24.5% reported following a diet to lose weight. Calcium intakes at different levels of fat intake showed that a low fat intake did not hinder calcium intakes, thus suggesting that the intake of dairy products was adequate for the soldiers who consumed the lowest fat intake. A nutrition education program that emphasizes the importance of dietary calcium and how to select low-fat calcium-rich foods needs to be established.

Low intakes of folic acid have been associated with neural tube defects, hence folic acid is of particular concern to pregnant women (Scott et al., 1990). It has been suggested that adequate folic acid intake is essential from at least four weeks before conception through the first three months of pregnancy (Rush et al., 1992). Although it is unlikely that U.S. Army female recruits would become pregnant during BCT (training constraints and rules forbid them from being sexually active), all of these women are of childbearing age and, historically, not all pregnancies are planned and some women may plan on becoming pregnant immediately after BCT.

Iron is another nutrient that is of particular importance for the military women. Through its role in oxidative metabolism, iron helps in maintaining work capacity (Gardner et al., 1977; Lukaski et al., 1991). Iron deficiency may affect both genders;

however, women are particularly at risk because of monthly menstrual bleeding. In the early 80s, Sauberlich et al. reported normal ranges (ferritin 22-447 ng/mL, iron saturation 20%-55%, hemoglobin 12-16 g/dL) for the mean hematological values for female West Point cadets (Sauberlich et al., 1982). Sauberlich and colleagues reported that the ferritin level of 33.3% of the female cadets indicated that they were at risk while 27.3% were at risk based on their iron saturation levels (Sauberlich et al., 1982). Ten years later, Friedl et al. reported that 36.6% of the female West Point cadets had a ferritin of < 12 ng/mL, 22% had iron saturation of < 16%, and 4.9% had hemoglobin of < 12 g/ dL (Friedl et al., 1990). However, serum markers of iron status were not significantly related to iron intakes (Klicka et al., 1993). Westphal et al. reported results from the Fort Jackson soldiers: 63.3% of the soldiers had a ferritin of < 12 ng/mL, 42.9% had iron saturation of < 16%, and 24.5% had hemoglobin of < 12 g/dL (unpublished observation; data reported by Westphal et al. [1994] are on 157 soldiers). In this case, dietary iron intake also did not correlate with the serum markers of iron status. Mean iron intakes decreased from 18.4 mg in 1988 to 16.2 mg in 1993. In 1988, none of the soldiers consumed < 70% of the MRDA for iron; in 1993, 10% of the soldiers consumed < 70%. Since the percentage of energy contributed from meat group/combination dishes and grains were similar between 1993 and 1988, the reason for the lower mean iron intake in 1993 is not evident.

There were some subtle differences between the soldiers in 1993 and 1988. For instance, the 1993 soldiers were older (59% were between 20 and 30 years old) than the 1988 soldiers (25% were between 20 and 30 years old). Furthermore, most of the soldiers in 1993 were from the South Atlantic region (29%) and East North Central region (22%). In 1988, most of the soldiers were from East North Central region (22%) with Middle Atlantic and West South Central regions being 18% each. Although both groups of soldiers were composed mainly of High School graduates (59% in 1993 and 73% in 1988), in 1993 there were almost twice the amount of soldiers with some college education than in 1988 (39% versus 20%, respectively). These differences in age, the parts of the country in which these soldiers lived the longest before joining BCT, and the soldiers' education levels may have influenced their eating preferences and dietary habits.

The nutrition knowledge data indicate that the mean nutrition knowledge scores were similar for the 1993 and the 1988 soldiers. These scores suggest that the nutrition knowledge of these two groups of soldiers entering BCT five years apart was fairly inadequate (64% and 66% for 1993 and 1988, respectively). But when these soldiers were asked to choose between a pair of alternatives the food that would help them practice better nutrition, the mean correct scores were much higher (94% and 89%, respectively). This suggests that these soldiers often had the ability to recognize nutritious choices, although they may lack fully adequate nutrition knowledge. Furthermore, when hypothetically asked which foods they would actually select if given the choices, 62% in 1993 and 50% in 1988 selected the most nutritious alternative. Paradoxically, although the 1993 soldiers did significantly better ($p \leq 0.05$) on this question than the 1988 soldiers, their nutritional intake was worse. All these confirm that nutrition knowledge may not always be the best indicator of dietary behavior.

CONCLUSIONS

Overall, there were clear dietary improvements over the five years between the two studies (e.g., fat and sodium intakes decreased while carbohydrate intake increased). Menu changes and adjustments are always at the discretion of the food service managers who follow the nutrition initiatives; thus changes due to menu alterations could have been predicted with a fair degree of accuracy. Dietary intakes that determine nutritional intakes, on the other hand, are more variable and difficult to predict. We postulate that most of the improvements seen in the nutritional intake of soldiers in 1993 were due to menu modification, not to the individual choices. The composite of decreased fat intake with a coincidental decrease in calcium intake and an increase in dietary cholesterol suggest that these soldiers' nutrition knowledge may not have been sufficient to make nutritious food choices. Even though nutrition knowledge may not reliably predict dietary behavior, nutrition education remains the cornerstone in motivating soldiers and families to select diets and adopt eating habits consistent with current knowledge relative to healthy eating practices.

RECOMMENDATIONS

More research is needed to ascertain the short- and long-term effects of sporadic and routine suboptimal nutrient intakes on nutritional status, health, and performance of military women. Considering that approximately 54% of the women in the U.S. Army are older than 25 years of age, particular emphasis should be given to including older military women in future studies.

The implementation of nutrition education programs tailored for the military woman is crucial. These programs should feature the importance of eating nutritionally balanced, varied diets, emphasizing the relevance of dietary calcium, iron, and folic acid on female health. Practical "how to" guidelines to assist military women in the selection of low-fat, nutrient-rich foods is a pivotal part of these programs.

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APPENDICES

APPENDIX A

Volunteer Agreement Affidavit

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25 or AR 40-38; the proponent agency is OTSG

PRIVACY ACT OF 1974

Authority: 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087

Principal Purpose: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; adjudication of claims; and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State, and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A — VOLUNTEER AFFIDAVIT

Volunteer Subjects In Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies

I, _____ SSN _____ ,

having full capacity to consent and having attained my _____ birthday, do hereby volunteer to participate in a research study entitled "Health, Performance, and Nutritional Status of U.S. Army Women during Basic Training"

(Research study)

under the direction of LTC Kathleen A. Westphal

conducted at Fort Jackson, S.C.

(Name of Institution)

The implications of my voluntary participation; duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by LTC Kathleen A. Westphal (phone 508-651-4875)

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights or study-related injury, I may contact

Office of Chief Counsel

at U.S. Army Natick Research, Development & Engineering Center (508-651-4322)

(Name, Address and Phone number — include Area Code)

I understand that I may at any time during the course of the study revoke my consent and withdraw from the study without further penalty or loss of benefits; however I may be required (military volunteer) or requested (civilian volunteer) to undergo certain examinations if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B — TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: *(Provide a detailed explanation in accordance with Appendix C, AR 40-38 or AR 70-25.)*

We would like your help to study some important problems about health and fitness of women in the Army. We are requesting your participation in a study to learn about: (1) the relationship between what you eat during basic training, your nutrition knowledge, and your general health, (2) the way the Army should measure body fat in women, and (3) how much your strength changes during basic training.

In order to volunteer for this study, you must be in good health. You should not volunteer for this study if you are trying to become pregnant, or if you think there is the possibility that you may be pregnant (for example, if you have had intercourse within the last month without the use of a reliable method of birth control, such as condoms or the birth control pill, you may be pregnant and not know it). If you have any questions about pregnancy or about medical risks from any of the tests in this study, you should ask for more information, either from the person who talks to you about this study or from the medical doctor assigned to this study.

The study includes the collection of a large amount of data at the beginning and end of basic training. Your participation will be required on one day at the beginning and end of basic training, and for relatively short periods during the basic training course. For example, some information about your diet will be collected for 7 days in the middle of basic training.

This is what we will ask you to do in this study:

Questionnaires (2 times: at the beginning & end of basic). Once, at the beginning of basic training, you will be asked to complete 3 questionnaires which give us information about you (age, where you come from, your ethnic background, health history, your usual physical activity, etc.), your eating patterns and attitudes towards food, and your nutrition knowledge and beliefs. This information is necessary to help us understand the other data which we collect. These questionnaires will take a total of about 90 minutes of your time.

At the completion of basic training, you will be asked to complete two of these questionnaires again so that we can determine how your nutrition knowledge and attitudes toward food may have changed during basic training. These questionnaires should take a total of about 30 minutes.

Body composition measurements (2 times: at the beginning & end of basic). Your body fat, muscle and bone will be measured twice to show what changes occur during basic training. Many measurements will be made of your body and these will be used to find out if there is a simple but accurate way to predict changes in fat, muscle, and bone during basic training. These simple measurements will then be compared to a very accurate measurement done with a special type of x-ray machine. All of these measurements will be made while you are wearing PT shorts and a T-shirt.

We will measure your weight, height, sitting height, and arm span. We will perform a "pinch test," which is a measure of the thickness of the fat layer near the surface of your skin. This will be done at 9 different locations on your body, including areas on your arm, chest, back, stomach, and legs. This test is done by a trained technician who holds the skin and measures the thickness with a skinfold caliper. This should cause very little discomfort. We will measure 15 circumferences of your body with a tape measure, including the neck, shoulder, chest, your waist at 3 levels, hips, and, on the right side of your body, your thigh, biceps, flexed biceps, forearm, wrist, knee, calf, and ankle.

We will also measure the resistance of your whole body to an electrical current with a method called "bioelectrical impedance." This is another easy way to predict body fat. This method may become useful to the Army if we can improve the accuracy. This measurement is done by attaching two sticky

SIGNATURE OF VOLUNTEER	DATE

PERMANENT ADDRESS OF VOLUNTEER	TYPED NAME OF WITNESS	
	SIGNATURE OF WITNESS	DATE

electrodes to your right foot and two to your right hand while you lay flat on your back on a comfortable pad. A small electrical current is passed through your body for 1 to 2 minutes while the device measures the resistance which your body provides to the current over a range of electrical frequencies. You will not be able to feel this electrical current. There is no risk associated with this method.

Our very accurate measurement of your body fat, muscle and bone will be done with a "dual-energy x-ray absorptiometry" (DEXA) machine. You will be asked to lie flat on your back on a padded table without moving. This test will take approximately 10 minutes as the scanner moves back and forth above your body. It will not cause you any pain or discomfort. The total amount of radiation which you will be exposed to from two scans on this machine is about the same amount that you are naturally exposed to in about 6 hours (less than 0.5 millirems) - or about 1/30th of the dose of a chest x-ray. Because this involves x-rays, you should not do this if there is any possibility that you may be pregnant.

Blood chemistry (3 times: at the beginning, at about 2-1/2 weeks, and at the end of basic). We will take blood samples 3 times during basic training to measure nutrients, hormones, and blood cells which indicate how healthy you are, if you are getting enough of the right foods (especially iron and calcium), and which indicate any stress effects from basic training (such as a decreased ability to fight off infection). We will take these blood samples by needle puncture of a vein in your arm. There is a small risk of a bruise forming at the puncture site, but this will gradually disappear. There is a risk of infection at the puncture site, but the chance that this will occur is slight. This procedure will be performed only by skilled and certified technicians. We will collect about 3 tablespoonfuls of blood each time. The total amount of blood collected over the course of the experiment will be about 9 tablespoonfuls. Part of the final blood sample will also be used to perform a pregnancy test (just as you will have had just before you started basic training) before we repeat the x-ray scan (DEXA) at the end of basic training.

Strength tests (2 times: at the beginning & end of basic). You will be asked to perform 9 tests which will measure your muscle strength. There is a slight risk that you could sustain a strain or sprain during the performance of any of these tasks. These tests will be administered by trained technicians who will instruct you in the proper technique and ensure that you perform the test correctly. These tests will be performed with equipment designed with your safety in mind. If you should experience trouble lifting a load, a technician will assist you in lowering the weights to the weight stand. The tests are:

1. The incremental dynamic lift will test your maximum lifting strength. From a squatting posture, you will grasp the handles of a weight machine, to which weights will be attached. You will then be asked to stand and bring the handles approximately to shoulder level. After each successful lift, you will return to your resting posture, and additional weight will be added to the machine. You should continue until you can no longer lift the weight. The weight will be added in increments of 10 pounds until your maximum lift ability has been achieved.
2. The arm curl will measure muscle strength in your arms. From a sitting position, you will be asked to use both hands to lift a bar to which weight has been added. You will begin each lift with your elbows straight, and try to bend your elbows towards your shoulders. After each successful lift, you will return to the resting position, additional weight will be added, and you will be asked to lift the bar again. You should continue until you can no longer lift the weight.
3. The bench press is another test of strength in your arms. You will be asked to lie on your back on a padded table, and then lift a bar to which weight has been added from a bent arm position to a straight arm position at chest level.
4. The vertical jump will measure the height you can jump to from a bent knee position.
5. In the 200 meter run, we will measure how fast you can run about 1/10th of a mile.
6. The box lift and carry will measure your ability to lift and carry a box with about 70 pounds in it around a 100 yard course. The actual weight used will be based on what you can lift in the maximum lift test and the test will be scored by how far you can carry this weight at waist height.
7. The repetitive lift will involve lifting a box filled with weight as many times as you are able in 5 minutes. The weight in the box will be 75% of that which you were able to maximally lift during your first lifting test on the machine.

8. The torque task will measure your maximal strength in handling a wrench. You will be asked to stand in front of a table and pull as hard as you can on a wrench with both arms while standing straight. The wrench will not move, but will record your pulling force.

9. For the backpack carry you will carry a 30 pound backpack over a flat 2 mile course as quickly as possible.

Daily measurements (most mornings, for the whole time you are in basic training). Before breakfast each morning, for the whole time you are in basic training and in this study, you will be asked to collect a urine sample and record some information on a clipboard which will be kept in the barracks latrine. We will ask you to weigh yourself in the barracks latrine each day in your gym shorts or underwear, and write your weight on a card along with your personal identification number. We will also ask you to write down whether or not you are currently menstruating (having your period). You will place your urine specimen and the card on which you have written your weight and information about your period, in a collection container located in the latrine. The urine samples will be tested for female hormones which tell us how the stress of basic training may affect your reproductive cycles. Changes in these hormones can affect you health status, the way you eat, and your body composition. The body weight changes will give us a detailed record of changes caused by different parts of your training. You will not be asked to make these measurements on days when the training schedule makes it inconvenient (for example, when you go to the field).

Dining hall survey (all meals for about 7 days, starting about 3 weeks into basic training). Midway through your training we will measure your nutritional intake by recording everything you eat at breakfast, lunch, and dinner for 7 days. Before you begin eating, we will ask you to show your tray to one of us. We will quickly record the amount of food you have on your tray without touching the food. When you have completed your meal, you will again show your tray to the same data collector who will quickly record the amount of food remaining, and also ask you how much you liked or disliked the food which you have just eaten and reasons for not eating (for example, did you have a poor appetite because you were you ill today?). Each recording session should take no longer than 2 minutes. We will make sure that the time is provided to do this so that you don't lose meal time.

Food diary (3 days). During a short field training exercise which occurs towards the end of your basic training course, we will ask you to keep a food diary in which you will record all the food and fluids which you take in during this period. This will require approximately ten minutes every day. At the completion of the field exercise, you will turn in the food diary. We will ask you to complete a field feeding questionnaire, which will take about ten minutes.

Measurement of energy expenditure (3-4 hours, 4 times during basic training). From names drawn out of a hat, a few of you will be asked to take part in one additional test. The selected volunteers will represent the entire group with this very accurate measurement of the amount of energy you expend through basic training. This test is done by drinking a small amount of a special form of water and then collecting urine samples every few days. The calories burned every day can be calculated accurately by how fast this water disappears from the body.

To perform this test you will be asked not to drink or eat anything for six hours prior to the test, then you will be given about 1/2 glass of modified water to drink. This water will contain a non-radioactive marker which is safe to drink. We will allow 3-4 hours for the modified water which you have drunk to mix with your body water. During this time, you will be asked not to perform any strenuous exercise or work, and not to eat, drink, smoke, or chew tobacco. This is usually done by having the volunteers recline in comfortable chairs and either nap or quietly read for about 3-4 hours. You will be scheduled to perform this test at a convenient time in your training schedule so that they do not miss any important training. A saliva sample (about 1 teaspoon) will be collected for chemical analysis three times (every hour) during this test. Saliva is collected simply by chewing on flavorless gum for a few minutes and repeatedly spitting, or emptying the contents of your mouth, into a small container. On the first day of this test and at various days later in the test, you will also be asked to provide a urine sample. To keep it simple, this sample will be part of the same daily morning urine sample which we will be asking all

volunteers to provide anyway. This sample will be analyzed only for the special water which were administered to you. There are no known risks to this procedure.

Medical records review (no time from your schedule required). Your medical records may be examined several times during basic training by a female doctor who is collecting additional research information about illnesses and injuries which you may have during basic training. This information will be handled just the same way as all of the other information which we collect in this study: it will be kept confidential, used only for the purposes of this research study, and individual information will be stored by study number instead of by your name or other identifiers.

The only direct benefit which you get from taking part in this study is detailed information about your nutrition, body composition, and strength. You will be able to see how your individual information compares to a summary of the whole group. You will obtain tests which usually cannot be obtained or would be very expensive services to buy. These include blood vitamin levels, accurate estimates of what you are eating, and very accurate information about your strength and body composition, including your bone calcium. This is information which is interesting and may be important to many women. You may request a copy of your personal results, as well as the summary results of the entire study.

Participation in this study is voluntary. If you choose not to take part, or if you choose to withdraw from the study, it will not change the course schedule for you. You may withdraw from the study at any time with no penalty or adverse action taken against you.

The information which you provide, along with the other information which we will collect, will be held in strict confidence. This means that nobody else can come to us (the research team) for information about your individual results; we will share these only with you. The information will be summarized anonomously in all reports which we write about this study and you and your data will not be identified anywhere in any reports. The only data which may be revealed to medical or Command authorities is information which may be important about your health. In other words, if we discover an abnormal test result which may indicate a serious health problem for you, we will bring it to your attention and we may also bring it to the attention of a physician who can determine whether or not you have a problem which needs medical attention. The information which you provide may be inspected by the officials of the U.S. Army Medical Research and Development Command.

Before signing this document, make certain that you have read and fully understand it.
If you have any questions concerning this study, please ask so that you have a complete understanding of the study. You may also ask questions during the study. You will be provided with a copy of this consent document for your information and your personal record.

APPENDIX B

Dining Facility 7-Day Menu

DAY 1 – 2 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, assorted

SALAD BAR
- Yogurt
- Cottage cheese
- Gelatin w/ Fruit

ASSORTED BREADS
- Wheat, White Bread
- Wheat, White Toast
- Crackers

ASSORTED FRUITS
- Oranges, Apples
- Bananas, Canned Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Margarine, pat
- Margarine, bulk
- Catsup
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH

ENTREES
- Pepper Steak w/ Gravy
- Veal Parmesan

STARCH
- Mashed Potatoes
- Steamed Rice

VEGETABLES
- Lima Beans
- Mixed Vegetables

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers
- Croutons

ASSORTED BREADS
- Wheat, White
- Crackers

ASSORTED FRUITS
- Oranges, Apples

DESSERTS
- Banana, Carrot, Choc and White Cake w/ Icing

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Catsup, Mustard, Relish
- 1000 Island dressing
- 1000 Island Red-Cal dressing
- Italian Red-Cal dressing
- Mayonnaise
- Sugar, Sugar Sub
- Creamer

DINNER

ENTREES
- Roast Beef w/ Gravy
- Fried Fish Portion
- Pepper Steak
- Chicken Patty
- Lasagna

STARCH
- Mashed Potatoes
- Steamed Rice

VEGETABLES
- Green Beans
- Cauliflower
- Lima Beans
- Mixed Vegetables

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers

ASSORTED BREADS
- White, Wheat, Rye
- Crackers

ASSORTED FRUITS
- Apples, Oranges, Pears

DESSERTS
- Apple, Cherry, Peach and Lemon Meringue Pie
- Carrot, Banana, White and Choc Cake w/ Frosting
- Bread Pudding

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Catsup, Relish, Tartar sauce
- French Red-Cal/Regular drsg.
- 1000 Island Red-Cal/Regular
- Italian dressing
- Sugar, Sugar Sub
- Creamer

DAY 2 -- 3 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Yogurt
- Cottage cheese

ASSORTED BREADS
- Rye Toast

ASSORTED FRUITS
- Oranges, Apples, Pears
- Bananas, Cnd Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Margarine, pat
- Margarine, bulk
- Catsup
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH *

ENTREES
- Braised Beef w/ Noodles

STARCH
- Rice w/ Gravy

VEGETABLE
- Carrots

SALAD BAR
- Lettuce w/ Cucumber

BREAD
- White, Wheat

FRUIT
- Oranges, Apples

DESSERT
- Coffee Cake

BEVERAGES
- Victory Punch
- Lemonade

CONDIMENTS
- Margarine
- French dressing
- Italian dressing

DINNER

ENTREES
- Salisbury Steak w/ Gravy
- Barbecued Beef
- Fried Chicken Patties
- Pepper Steak
- Spaghetti w/ Meat Sauce

STARCH
- Steamed Rice
- Mashed Potatoes
- Garlic Bread

VEGETABLE
- Spinach
- Succotash

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers

ASSORTED BREADS
- White, Wheat, Rye
- Crackers

ASSORTED FRUITS
- Apples, Oranges, Pears

DESSERTS
- Carrot, Choc, White and Banana Cake w/ Icing
- Apple and Cherry Pie

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Catsup, Mustard
- Relish, Tartar sauce
- Mayonnaise
- French Red-Cal/Regular dsg.
- Italian dressing
- Parmesan cheese
- Sugar, Sugar Sub
- Creamer

*meal served in the field

DAY 3 -- 4 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Yogurt
- Cottage cheese

ASSORTED BREADS
- White, Wheat Toast

ASSORTED FRUITS
- Oranges, Apples, Pears
- Bananas, Canned Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Margarine, pat
- Margarine, bulk
- Catsup
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH

ENTREES
- Hamburger
- Cheeseburger
- Grilled Cheese and Ham
- Chili Dog
- Sloppy Joe
- Pepperoni Pizza

STARCH
- French Fries
- Potato Chips
- Corn Chips

VEGETABLE
- Baked Beans
- Corn-on-the-Cob

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs
- Chow Mein Noodles
- Olives, Pickles,
- Pickled Peppers

ASSORTED BREADS
- White, Wheat Bread

ASSORTED FRUITS
- Oranges, Apples, Pears

DESSERTS
- Cookies

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Catsup
- Mayonnaise
- 1000 Island Red-Cal/Regular
- Italian Red-Cal dressing
- Sugar, Sugar Sub
- Creamer

DINNER

ENTREES
- Swiss Steak w/ Gravy
- Veal Parmesan

STARCH
- Steamed Rice
- Egg Noodles

VEGETABLES
- Waxed Beans
- Baked Beans
- Corn-on-the-Cob

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers

ASSORTED BREADS
- White, Wheat

ASSORTED FRUITS
- Apples, Oranges, Pears

DESSERTS
- Cookies

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Mayonnaise
- 1000 Island dressing
- French Red-Cal/Regular drsg.
- Italian Red-Cal/Regular drsg.
- Sugar, Sugar Sub
- Creamer

DAY 4 -- 5 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Fried eggs
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Cottage cheese

ASSORTED BREADS
- White, Wheat Toast
- White, Wheat Bread

ASSORTED FRUITS
- Oranges, Pears
- Bananas, Canned Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Margarine, pat
- Margarine, bulk
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH *

SOUP
- Chicken Noodle

ENTREES
- Chili Con Carne
- Baked Ham
- Swiss Steak w/ Gravy

STARCH
- Steamed Rice

VEGETABLES
- Corn
- Carrots

SALAD BAR
- Lettuce w/ Tomato

ASSORTED BREADS
- White, Wheat
- Crackers

ASSORTED FRUITS
- Oranges

DESSERTS
- Crumb Cake
- Cookies

BEVERAGES
- Victory Punch
- Lemonade
- Coffee
- Cocoa

CONDIMENTS
- Margarine
- 1000 Island dressing
- French dressing

DINNER

SOUP
- Chicken Noodle

ENTREES
- Pot Roast w/ Gravy
- Swedish Meatballs
- Chili Con Carne

STARCH
- Mashed Potatoes
- Oven Browned Potatoes
- Steamed Rice

VEGETABLES
- Fried Cabbage w/ Bacon
- Black-eyed Peas w/ Bacon

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers
- Pickles/Cauliflower/Onions

ASSORTED BREADS
- White, Wheat, Rye
- Crackers

ASSORTED FRUITS
- Oranges, Pears

DESSERTS
- Apple, Peach, and Lemon Meringue Pie
- Spice, Banana and White Cake w/ Icing

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Relish, Tartar sauce, Mayo
- Italian Red-Cal/Regular drsg.
- 1000 Island Red-Cal/Regular
- French Red-Cal dressing
- Sugar, Sugar Sub
- Creamer

*meal served in the field

DAY 5 -- 6 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Yogurt
- Cottage cheese

ASSORTED BREADS
- White, Wheat Toast
- White, Wheat Bread

ASSORTED FRUITS
- Oranges, Grapefruit, Pears, Bananas, Canned Peaches Cnd Pineapple, Cnd Pears Fruit Cocktail

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Margarine, pat
- Margarine, bulk
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH *

SOUP
- Tomato Vegetable

ENTREES
- Braised Beef w/ Egg Noodles
- Swiss Steak w/ Gravy

STARCH
- Mashed Potatoes
- Steamed Rice

VEGETABLES
- Carrots
- Peas

SALAD BAR
- Lettuce and cucumber
- Tomato wedges

ASSORTED BREADS
- White, Wheat, Rye

ASSORTED FRUITS
- Oranges, Pears

DESSERTS
- Coffee Cake
- Cookies

BEVERAGES
- Victory Punch
- Lemonade

CONDIMENTS
- Margarine
- 1000 Island Red-Cal/ Regular dressing

DINNER

SOUP
- Chicken Noodle
- Tomato Vegetable

ENTREES
- Turkey Pot Pie
- Liver and Onions
- Fried Fish Portions
- Barbecued Beef on Roll

STARCH
- Fried Rice
- Duchess Potatoes/Gravy

VEGETABLES
- Peas
- Mixed Vegetables
- Carrots

SALAD BAR
- Lettuce, Tomatoes
- Onions, Cucumber
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Cucumber and Onion Salad
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar Cheese, Chow Mein Noodles
- Mushrooms, Olives, Pickles
- Pickled Peppers

ASSORTED BREADS
- White, Wheat, Rye
- Crackers

ASSORTED FRUITS
- Oranges, Pears

DESSERTS
- White, Banana, Spice and Choc Cake w/ Icing
- Apple Pie

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Italian dressing
- 1000 Island Red-Cal drsg.
- Mustard, Tartar sauce
- Sugar, Sugar Sub
- Creamer

*meal served in the fie

DAY 6 -- 7 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Cheddar cheese

ASSORTED BREADS
- White Toast
- White Bread

ASSORTED FRUITS
- Oranges, Grapefruit, Pears
- Canned Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly
- Syrup
- Catsup,
- Margarine, pat
- Margarine, bulk
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH

ENTREES
- Meatloaf w/ Gravy
- Chili Macaroni
- Fried Chicken Patty

STARCH
- Steamed Rice
- Mashed Potatoes

VEGETABLES
- Peas w/ Onions
- Mexican Corn

SALAD BAR
- Lettuce, Tomatoes, Onions
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Potato Salad
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Mushrooms, Olives, Pickles
- Pickled Peppers
- Pickles/Cauliflower/Onions

ASSORTED BREADS
- White, Wheat Bread
- Crackers

ASSORTED FRUITS
- Oranges, Apples, Pears

DESSERTS
- White, Banana and Choc Cake w/ Icing
- Apple Pie

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Orangeade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- Catsup, Mustard
- Mayonnaise
- 1000 Island Red-Cal
- Italian Red-Cal drsg.
- French dressing
- Sugar, Sugar Sub
- Creamer

DINNER

ENTREES
- Yankee Pot Roast w/ Gravy
- Baked Stuffed Pork Chop
- Chili Macaroni
- Meatloaf Sandwich

STARCH
- Steamed Rice
- Mashed Potatoes

VEGETABLES
- Green Beans
- Mixed Vegetables
- Peas w/ Onion
- Mexican Corn

SALAD BAR
- Lettuce, Tomatoes, Onions
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Potato Salad
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar
- Cheese, Chow Mein Noodles
- Mushrooms, Olives, Pickles
- Pickled Peppers

ASSORTED BREADS
- White, Wheat Bread

ASSORTED FRUITS
- Apples, Oranges, Pears

DESSERTS
- White, Spice and Banana Cake w/ Icing
- Apple and Cherry Pie

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Orangeade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- 1000 Island dressing
- Italian Red-Cal/Regular drsg.
- French Red-Cal dressing
- Catsup, Relish
- Sugar, Sugar Sub
- Creamer

DAY 7 -- 8 APRIL 1993

BREAKFAST

MEATS
- Bacon
- Sausage Patty
- Creamed Ground Beef

EGGS
- Scrambled
- Hard-boiled
- Cheese Omelet

STARCH
- Hash Browned Potatoes
- Pancakes
- Waffles

CEREAL
- Oatmeal
- Grits
- Ready-to-Eat, asst.

SALAD BAR
- Cottage cheese

ASSORTED BREADS
- White Toast
- White Bread

ASSORTED FRUITS
- Oranges, Apples, Pears
- Bananas, Cnd Peaches
- Cnd Pineapple, Cnd Pears

BEVERAGES
- 1% White Milk
- 1% Choc Milk
- Skim Milk
- Orange, Grape Juice
- Victory Punch
- Coffee, Tea, Cocoa

CONDIMENTS
- Peanut butter
- Jelly, Jam
- Syrup, Catsup
- Margarine, pat
- Margarine, bulk
- Sugar, Sugar Sub
- Creamer
- Honey
- Raisins

LUNCH *

ENTREES
- Veal Steak w/ Gravy

STARCH
- Steamed Rice

VEGETABLES
- Black-eyed Peas

SALAD BAR
- Lettuce w/ Tomato

ASSORTED BREADS
- White Bread

ASSORTED FRUITS
- Oranges

DESSERTS
- Coffee Cake

BEVERAGES
- Victory Punch
- Lemonade
- Coffee

CONDIMENTS
- Margarine
- Catsup
- 1000 Island Red-Cal dsg.
- French Red-Cal dressing

DINNER

ENTREES
- Braised Ribs
- Spaghetti w/ Meat Sauce
- Hot Turkey Sandwich w/ Gravy

STARCH
- Mashed Potatoes
- Steamed Rice
- Garlic Bread

VEGETABLES
- Black-eyed Peas
- Green Beans
- French Fried Cauliflower

SALAD BAR
- Lettuce, Tomatoes, Onions
- Macaroni Salad
- Carrot and Raisin Salad
- Coleslaw w/ Creamy Dressing
- Gelatin w/ Fruit
- Hard-boiled eggs, Cheddar Cheese, Chow Mein Noodles
- Olives, Pickles
- Pickled Peppers
- Pickles/Cauliflower/Onions

ASSORTED BREADS
- White, Wheat
- Crackers

ASSORTED FRUITS
- Apples, Oranges, Pears

DESSERTS
- White, Banana, Spice and Choc Cake w/ Icing

BEVERAGES
- 1% White and Choc Milk
- Victory Punch
- Lemonade
- Ice Tea, sweetened
- Ice Tea, unsweetened
- Carbonated drinks, asst.
- Coffee, Tea, Cocoa

CONDIMENTS
- Margarine
- 1000 Island dressing
- Italian dressing
- Catsup, Relish
- Parmesan cheese
- Sugar, Sugar Sub
- Creamer

*meal served in the field

APPENDIX C

Visual Estimation Data Collection Form

Ft. Jackson Visual Estimation Data Collection Form

Subject Name: ______________________ Meal: B L D Date: ______

Subject Number: __________ Data Collector: __________

Food Item:	Food Code:	Amount Served:	Amount Returned:	Reason Not Eaten:

APPENDIX D

Assumptions for Recipe Coding

ASSUMPTIONS FOR RECIPE CODING

COOKED VEGETABLES

1. The nutrient data base item with the description BOILED W/O SALT was used for vegetables in recipes. The water used to cook the vegetables was not included in the coded recipe because it is already accounted for in the cooked vegetable.

2. Cooking yields were obtained from Handbook 102.

3. A 10% yield for the salt for cooking vegetables was used. A 25% salt retention was assumed for cooking potatoes.

4. If butter was poured over vegetables in serving trays, a 75% yield was used for the butter.

CANNED VEGETABLES AND FRUITS

1. If a recipe included drained vegetables then a yield factor was used to determine the drained weight. Yields were obtained from Handbook 102 or the Federal Supply Catalog.

2. For canned fruits that were drained the total recipe weight of the fruit was used since the nutrient data base contains canned fruits with solids and liquids only. This overestimates carbohydrate content in recipes with drained canned fruit.

MEATS

1. If a recipe called for meat with bone, the percentage of bone was subtracted from the recipe weight to obtain an edible portion weight. Bone percentages were obtained from Handbook 102 or Handbook No. 8.

2. The cooked data base ingredient was used for all meats in recipes. Cooking yields were obtained from Handbook 102 or Handbook 8. The yield chosen reflected thawing and cooking losses (drippings and volatiles) for the specific weight of meat

and cooking method.

3. When meats were sprinkled with salt, pepper or other spices a 75% yield for the spice was used.

4. For oven or pan-frying meats, a 40% yield for the fat was used.

5. For meats/fish cooked on a griddle, assumed 1 cup oil/ 100 servings if no fat amount was obtained.

6. For deep fat frying, assumed 1 pound fat/100 servings or selected "fried" data base item.

7. A 30% yield for oil brushed on meat when roasting was used.

8. A recipe for soy-extended ground beef was used from data from chemical analysis of a sample by the USANRDC food chemistry lab and the contract lab Rosner/Runyon. The recipe (ingredient) code is SOYGRBF and data is stored in a file called [NUTRITION.RECIPE_ING]ING93.ING. This recipe includes a 3% fat loss. Since it was assumed that there was no fat lost in all Creamed Ground Beef (L030C3) recipes due to the addition of the remaining recipe ingredients into the same pan as the beef, 3% of the original beef amount was added as beef fat.

FATS

1. The USDA data base code #04034 for soybean oil was used.

2. For vegetables a 25% yield for fat was used when vegetables were sauteed and the fat was drained, or were transferred to another pan for further cooking. A 100% yield was used when other recipe ingredients were added to the pan that the vegetables were cooked in.

3. A 40% yield for the oil used to fry eggs was used. Assumed 2 cups of oil per 100 servings if the oil amount was not obtained.

4. A 80% yield for oil used to grill pancakes was used. Assumed 2 cups of oil per 100 servings if the oil amount was not obtained.

GRAINS

1. The data base item for cooked grains (pasta, rice, cereal) was used and a yield for cooking in water was applied. The water for cooking grains was not included since it was accounted for in the cooked grain.

2. Salt retained in cooked pasta was estimated by figuring the percentage of water absorbed into pasta. The amount of raw pasta was subtracted from the amount of cooked pasta to determine the amount of water absorbed. This divided by the weight of water initially used to cook the pasta gives the percentage of water absorbed. This percentage was multiplied by the amount of salt in the recipe to estimate the amount of salt absorbed.

3. Assumed 50% of the oil is retained in cooked pasta from the oil used in the water.

4. Assumed all salt and oil retained in rice from cooking water.

SEASONINGS/BATTERS

1. Assumed a 80% yield for ingredients used for dipping and dredging foods.

2. Assumed a 50% yield for basting ingredients or a 70% yield if marinated also.

3. Omitted bay leaves and whole cloves since they were not consumed.

MISCELLANEOUS

1. The dry pancake mix was coded as a recipe using the percentages by weight of ingredients listed in the military specification #MIL-B-44275A, Class 2, Style C.

2. The Pillsbury mashed potato granule mix with added vitamin C was coded as a recipe using the USDA code # 11380 for potato granules plus 121.75 mg of ascorbic

acid per 100 gm potato granules to equal the amount of ascorbic acid contained in the actual product.

Ingredient codes are PANWAFMX92 and POTATODRY respectively in file [NUTRITION.RECIPE_ING]ING93.ING

3. Nutrient values for the following two items were added to the study database (T9301.TAB):

Code	Food name	Reason
COMPLETE-B	Kellogg's Complete Bran Flakes	not in database
RAISINBRAN	Kellogg's Raisin Bran	Iron value reported by manufacturer varied from database value

4. The recipe for Victory Punch contains an average of the standard recipe provided by the kitchen and one actual observed recipe.

5. Vanilla extract was coded as water since that item is not contained in the database.

APPENDIX E

Major and Minor Food Groups (1993)

MAJOR AND MINOR FOOD GROUPS
(1993)

Dairy
- Cheese
- Milk Beverages
- Yogurt

Meat
- Bacon
- Beef
- Soy Extended Beef
- Chicken
- Cured Meats
- Eggs
- Fish
- Pork
- Turkey
- Sausage Products
- Veal

Combination Dishes
- Beef/Grain
- Beef/Vegetable
- Beef/Grain/Vegetable
- Beef/Legume
- Poultry/Vegetable
- Cheese/Grain

Grains
- Bread, Rye
- Bread, Wheat
- Bread, White
- Cereals, Cooked
- Cereals, Ready-to-Eat
- French Toast
- Pancakes, Waffles
- Pasta
- Rice

Legumes
- Blackeyed Peas
- Peanut Butter
- Lima Beans

Vegetables
- Dark Green, Leafy
- Potatoes
- Starchy Vegetables
- Tomatoes
- Yellow Vegetables
- Other Vegetables

Fruits
- Citrus Fruits/Juices
- Non-citrus Fruits/Juices

Desserts
- Cake
- Syrup
- Candy
- Cookies
- Jello
- Pie
- Sugar

Fat and Oils
- Non-dairy Creamer
- Gravy
- Margarine
- Salad Dressing

Other
- Crackers
- Chips
- Condiments
- Tea
- Beverage Base
- Coffee
- Soft Drinks

APPENDIX F

Field Feeding Questionnaire

FIELD FEEDING QUESTIONNAIRE

This questionnaire asks you questions about food and feeding conditions in the field. Your answers will be kept strictly confidential. Please answer each question honestly and thoughtfully and use a number two pencil to fill in the ovals. When you are finished, please check to make sure that you have answered all of the questions. Thank you.

Subject Number:_____

Proper Mark

For Office Use Only

1. **How many days were you out in the field during the training exercise? (select one)**

   ◯ One Day ◯ Two Days ◯ Three Days

2. **How many meals did you eat during the field training exercise? (select only one per column)**

Breakfast	Lunch	Dinner
◯ None	◯ None	◯ None
◯ One	◯ One	◯ One
◯ Two	◯ Two	◯ Two
◯ Three	◯ Three	◯ Three

3. **In your opinion, how does your field intake compare with your dining hall intake? (select only one)**

   ◯ Eat Less ◯ Eat More ◯ Eat the Same ◯ I Don't Know

4. **I did not eat much during the recent field training exercise because (select all those that apply):**

	Yes	No
My hands were not clean	◯	◯
I did not want to have to go to the bathroom	◯	◯
I wanted to lose weight	◯	◯
I was not hungry	◯	◯
I don't like to be told what to eat	◯	◯
It was not my usual meal time	◯	◯
I was not given enough time to eat	◯	◯
The weather was bad	◯	◯
The food's temperature was not right	◯	◯
The food did not look good	◯	◯
I was not eating with my friends	◯	◯
I had menstrual cramps	◯	◯
I was not feeling well	◯	◯

APPENDIX G

Major and Minor Food Groups (1988)

MAJOR AND MINOR FOOD GROUPS
(1988)

Dairy
- Cheese (Natural)
- Milk Beverages
- Yogurt

Meat/Entree
- Bacon
- Sausage Products
- Beef
- Soy Extended Beef
- Chicken
- Cured Meats
- Eggs
- Fish
- Pork
- Turkey
- Veal

Combination Dishes
- Beef/Grain
- Beef/Vegetable
- Beef/Grain/Vegetable
- Poultry/Vegetable

Grains
- Bread, Rye
- Bread, Wheat
- Bread, White
- Cereals, Cooked
- Cereals, Ready-to-Eat
- Pancakes, Waffles, French Toast
- Pasta
- Rice

Legumes
- Nut Butter

Crackers and Chips
- Saltine Crackers
- Chow Mein Noodles

Vegetables
- Dark Green, Leafy
- Potatoes
- Starchy Vegetables
- Tomatoes
- Yellow Vegetables
- Other Vegetables

Fruits
- Citrus Fruits/Juices
- Non-citrus Fruits/Juices

Desserts/Sweets
- Cakes
- Jelly/Jam
- Gelatin Salads/Desserts
- Sugar
- Honey/Syrup

Fats
- Gravies
- Margarine
- Salad Dressing
- Coffee Whitener
- Sour Cream

Condiments
- Catsup
- Mustard
- Pickles
- Sauces
- Salt

Beverage
- Coffee
- Soft Drinks (carbonated)
- Tea
- Beverage Base

APPENDIX H

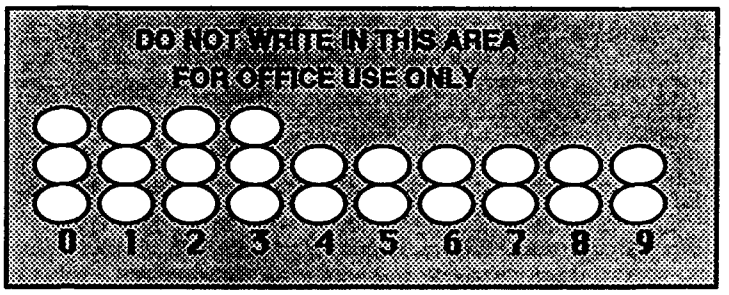
Nutrition Knowledge Questionnaire

Subject Number: _____

NUTRITION KNOWLEDGE AND BELIEFS QUESTIONNAIRE

The following questions are related to overall nutrition knowledge and beliefs. We do not expect you to know all the correct answers. Please fill in the oval next to the correct answer for each question. Give only one answer for each question. Thank you.

Proper Mark



1. Fast food meals are usually:
- ◯ high in protein and low in salt
- ◯ not at all nutritious
- ◯ high in salt and fat
- ◯ high in sugar and low in fat
- ◯ high in fat

2. Calcium:
- ◯ is a major source of energy
- ◯ helps build bones and teeth
- ◯ is found primarily in eggs
- ◯ is found primarily in fruits
- ◯ is toxic in your diet

3. Protein is found in:
- ◯ vegetable oil
- ◯ meats, fish and poultry
- ◯ fruits
- ◯ meats only
- ◯ none of the above

4. Carbohydrates are:
- ◯ found in grains
- ◯ higher in calories than fats
- ◯ building blocks of protein
- ◯ found in meats
- ◯ higher in calories than protein

5. Lean meats are a good source of:
- ◯ vitamin E
- ◯ the B vitamins
- ◯ vitamin C
- ◯ vitamin D
- ◯ carbohydrates

6. Iron:
- ◯ is found in cheese
- ◯ is a kind of vitamin
- ◯ is found in salt
- ◯ is found in whole grains and red meats
- ◯ none of the above

7. Low fat milk has:
- ◯ a. fewer calories than whole milk
- ◯ b. less cholesterol than whole milk
- ◯ c. as much calcium and protein as whole milk
- ◯ d. a and b only
- ◯ e. all of the above

8. Which nutrient gives the MOST energy (calories) per ounce?
- ◯ fat
- ◯ protein
- ◯ carbohydrates
- ◯ sugar
- ◯ vitamins

9. **Which food is in the SAME food group as chicken?**
   - ◯ yogurt
   - ◯ fish
   - ◯ potatoes
   - ◯ apples
   - ◯ cereal

10. **Which entree is the BEST choice for a reducing diet?**
   - ◯ fried chicken
   - ◯ broiled fish
   - ◯ broiled steak
   - ◯ macaroni and cheese
   - ◯ ham and cheese sandwich

11. **Which food is LOWEST in sodium (salt)?**
   - ◯ american cheese
   - ◯ baked potato
   - ◯ canned tomato soup
   - ◯ bologna
   - ◯ corn flakes

12. **Young adult women of average weight and low activity should consume about how many calories per day?**
   - ◯ 500
   - ◯ 1000
   - ◯ 2000
   - ◯ 5000
   - ◯ 7000

13. **Which of the following is NOT a good source of fiber?**
   - ◯ carrots
   - ◯ popcorn
   - ◯ steaks
   - ◯ almonds
   - ◯ celery

14. **What are the four major food groups?**
   - ◯ proteins, grains and cereals, milk products, meats
   - ◯ milk products, grains and cereals, fruits and vegetables, meats
   - ◯ fruits, vegetables, milk products, proteins
   - ◯ milk products, grains and cereals, fats and oils, meats
   - ◯ none of the above

TRUE	FALSE	
◯	◯	15. **Water is essential for the body to function properly.**
◯	◯	16. **Fat has more than twice the calories as carbohydrates.**
◯	◯	17. **It is necessary to take a vitamin pill to obtain all the essential nutrients.**
◯	◯	18. **The ingredients listed on food labels are arranged in order of decreasing quantity.**
◯	◯	19. **When you're physically active, you need more calories than when you're inactive.**
◯	◯	20. **Ice cream is a good source of calcium.**
◯	◯	21. **Margarine has less calories than butter.**

22. **Eating which of these items would help you practice better nutrition? Choose a food from either column A or B for each pair (e.g., choose between butter and margarine). Do this for each pair listed.**

A	B
butter	margarine
low fat (2%) milk	whole milk
unsweetened juice	canned soda
fried foods	baked goods
herbal seasonings	salt
pastries	fresh fruit
chicken with skin	chicken without skin

23. **If you are trying to lose weight which item would you choose from column A or B?**

A	B
regular menu option	low calorie menu option
fresh fruit	pastries
low calorie dressing	regular dressings
whole milk	low fat (2%) milk
fried food	baked foods
reduced portions	regular portions
potatoes with gravy	potatoes without gravy
Frosted Flakes	Shredded Wheat
chicken with skin	chicken without skin

24. **If given the choice between the food in column A or the food in column B, which would you choose?**

A	B
baked chicken	fried chicken
low calorie foods	high calorie food
whole milk	low fat milk
non-buttered vegetables	buttered vegetables
fresh fruit	cakes and pies
potatoes with gravy	potatoes without gravy

For each of the items listed below we would like you to use the following scale to rate your agreement or disagreement with the statement. There are no right or wrong answers. We are seeking your opinion.

STRONGLY DISAGREE	DISAGREE	NEUTRAL OR UNDECIDED	AGREE	STRONGLY AGREE
1	2	3	4	5

25. It is important to take additional salt on hot humid days if you are very active and are sweating a lot. 1 2 3 4 5

26. The best way to lose weight is to eat fewer foods that are high in carbohydrates such as bread, pasta, and rolls. 1 2 3 4 5

27. The information about nutrition I had prior to joining military service: 1 2 3 4 5

has influenced my food choices at restaurants and at home.
has increased my awareness of proper nutrition.
has improved my attitude toward proper nutrition.

28. Proper nutrition: 1 2 3 4 5

is important to overall health.
is important to overall fitness.

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